The Electrical Industry's Weekly Magazine

February 10, 1958

Electrical World

Price 50 Cents

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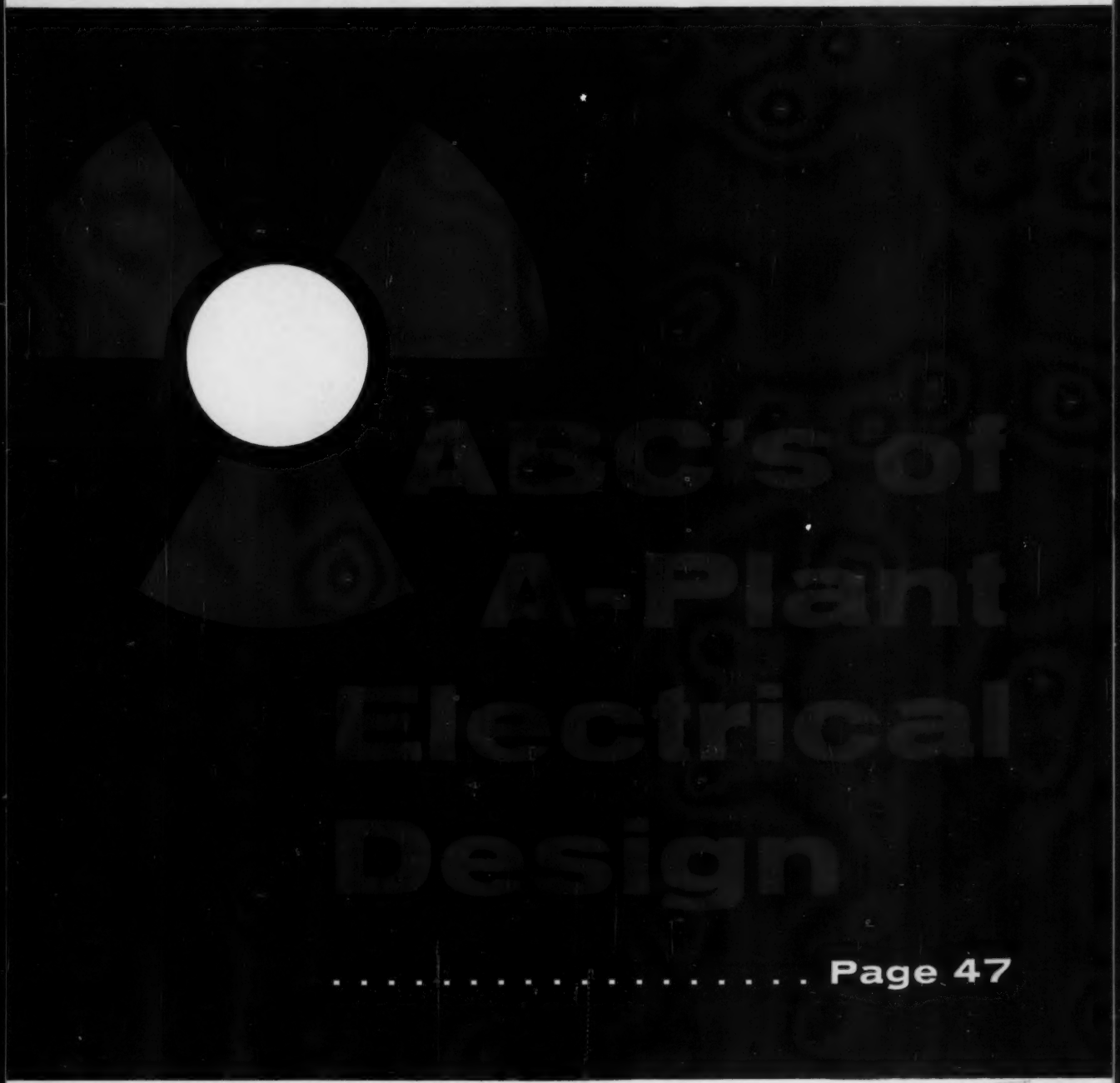

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UTILITY PRESIDENTS REPORT:

Economic Future Is Bright . . . Page 43

E R POWER GS W
UNIVERSITY MICROFILMS 1
313 N 1 ST
ANN ARBOR MICH

HIGHLY POLISHED SURFACE of thrust bearing runner plate affords dependable operation of G-E hydro-generators. When completed, this bearing will support 3,816,000 pounds. Watching operator "stone" surface for smoothness are General Electric's R. B. Bodine (left), Mgr.—Large Generator and Converter Sales, and R. B. McKeeby, Mgr.—Mechanical Design Engineering, Large Motor & Generator Dept.

FOR MODERN SYSTEM PLANNING . . .

Intensive development of hydro sites is an answer to "peaking"

Utility planning engineers find that intensive use of hydro-electric developments for supplying "peaking power" is an economic answer to relatively high investment costs for generating capacity. Hydro-electric sites with limited storage, or with the possibility of pumped storage, are being used effectively to supply "peaking power." General Electric hydro-generators driven by modern hydraulic turbines provide for all requirements of this type of application. One of the most important components contributing to the outstanding performance of these generators is the General Electric spring thrust bearing.

RAPID START

Generating equipment for peaking service must be started and stopped each day, perhaps several times daily. General Electric hydro-generators driven by hydraulic turbines can be started and loaded as often and as rapidly as required. No involved starting procedures are necessary to insure satisfactory operation.

OUTSTANDING RELIABILITY

Operating reliability of General Electric thrust bearings has been nearly perfect since this design was introduced in 1945. Since then, over 300 bearings have operated for more than 2400 machine-years with only 12 machine-days' outage during commercial operation due to thrust bearings. This is an average outage of only six hours per machine in fifty years.

3,816,000 LB. BEARING LOAD

As testimony of the great capacity of General Electric thrust bearings, the bearing pictured above will support a load of 3,816,000 pounds. In one installation, twelve similar bearings each carry a load of 4,000,000 pounds, a third more than the previous high which is also a General Electric installation.

For more information on how G-E thrust bearings can help you meet peaking requirements through the development of hydro-electric sites, contact your General Electric Apparatus Sales office or request bulletin GEA-2251E from General Electric Company, Section 301-376, Schenectady 5, N. Y.

MORE POWER TO AMERICA

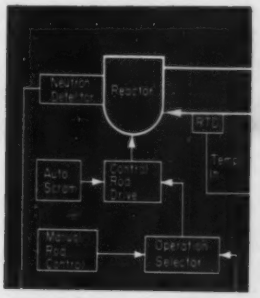
GENERAL ELECTRIC

Electrical World

Vol. 149, No. 6 FEBRUARY 10, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue



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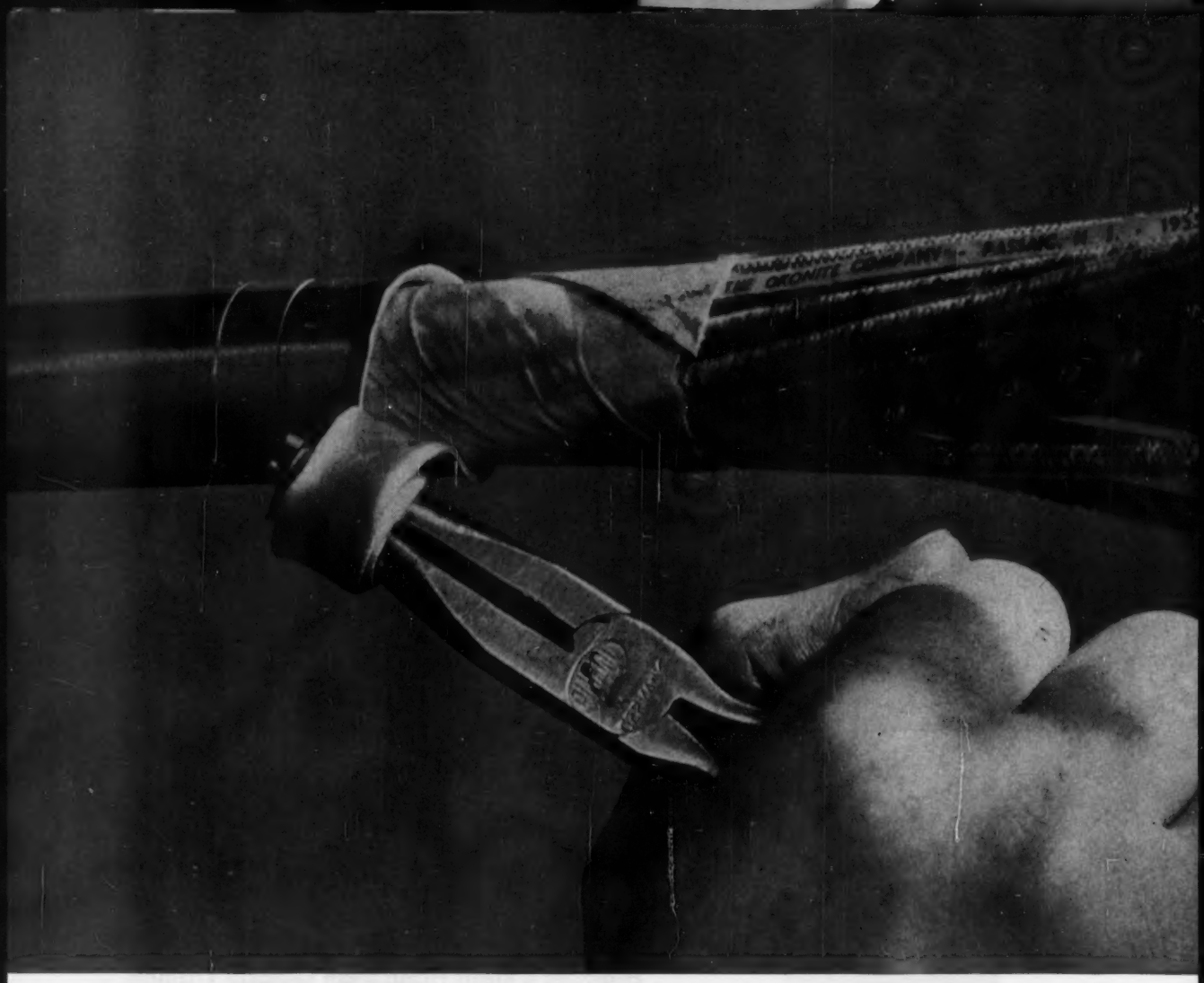

ALUMINUM-SHEATHED CABLES

...light ...strong ...smaller diameter ...easy to install and terminate

A seamless aluminum sheath over Okonite cables provides a durable, conduit-type covering of high tensile strength. Yet this aluminum sheath is easily worked with standard conduit tools. It can be bent around obstructions . . . terminated at boxes, transformers, and the like . . . trained in trays . . . or supported by conventional brackets and cable clamps. Standard fittings are available. This low-cost alternate to rigid conduit is available with virtually any Okonite insulation such as rubber, plastic or varnished cambric.

Here are some important benefits of Okonite's aluminum-sheathed cables:

Reduced diameter and lighter weight.

Impervious barrier to liquids and vapors.

Excellent flame resistance.

Costs less than regular conduit installations.

Great mechanical strength, yet easily worked.

For complete data on Okotherm-insulated (silicone rubber compound) aluminum-sheathed cable for use in high ambients up to 200C (392F), contact your Okonite representative or write for Bulletin EW 1088A, The Okonite Company, Passaic, N. J. 4742

where there's electrical power . . . there's **OKONITE CABLE**

Don't Lose the Index

Now when did you read that article about a sampling technique that cut meter testing costs? Remember that the state public service commission had approved the method. And it was in Electrical World sometime during the past six months.

It is with questions like this that our semi-annual index will help you. You'll find the latest one covering July-December 1957 in last week's issue. Flip over to the section on "Meters and Measuring" and run down the entries. There it is—the last one: "Vepco sampling technique cuts meter testing cost."

These indexes, which are bound into our regular issue are carried about a month following the mid-year and the year-end.

You'll find the index more helpful as you become familiar with it. May I suggest that you leaf through these pages to note the breakdown of topics. You will see that we are trying to key many of the article titles to utility departments—distribution, transmission, financial. But there are still many classified according to subject—wiring, turbines, television. Some familiarity is required to make the best use of it.

Counting the "Author's Index" you'll find more than 1,500 entries in the latest index. We hope you'll find it useful. But if you still can't locate an article, just drop us a note. We'll be glad to help.

Fischer Black

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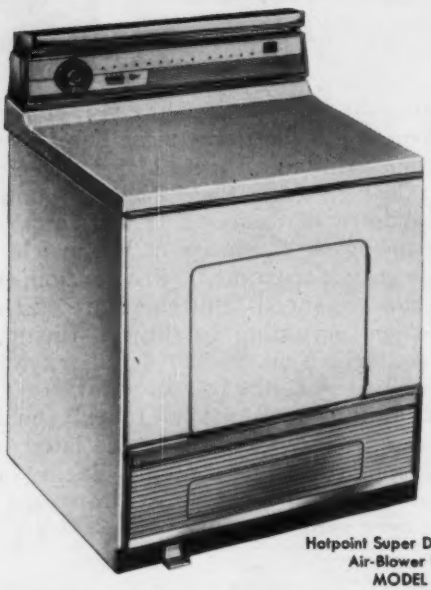
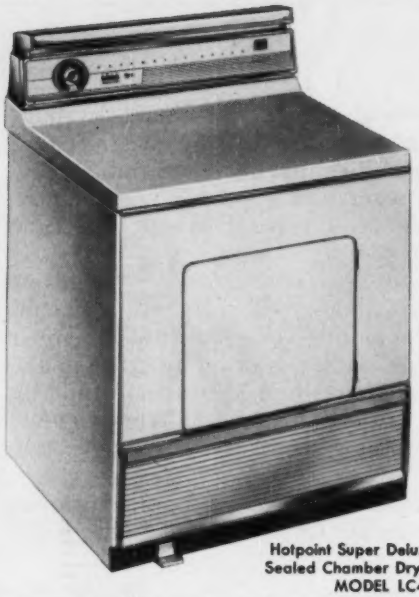


Hotpoint Super Deluxe
Air-Blower Dryer
MODEL LB45



Hotpoint Super Deluxe
Sealed Chamber Dryer
MODEL LC45

Your solution to increased revenue...

Hotpoint

Automatic Electric Dryers for '58!

Hotpoint offers a complete selection of Automatic Electric Dryers to help you put more of these revenue-producing appliances on your lines. The 1958 Hotpoint Line includes two types, six models. There's one for every need, every budget —each with distinctive new Hotpoint CLEAN-LINE Styling, and loaded with the super sales-appeal that only Hotpoint advanced features can create!

Your Hotpoint Distributor has complete details on Hotpoint's aggressive merchandising support, feature versatility and presold popularity. Ask him to show you how easy it is to build profitable load—and to develop *sustained* revenue—with Hotpoint Automatic Electric Dryers! They will help you put more POWER in "Housepower"—more LIVING in "Live Better . . . Electrically!"

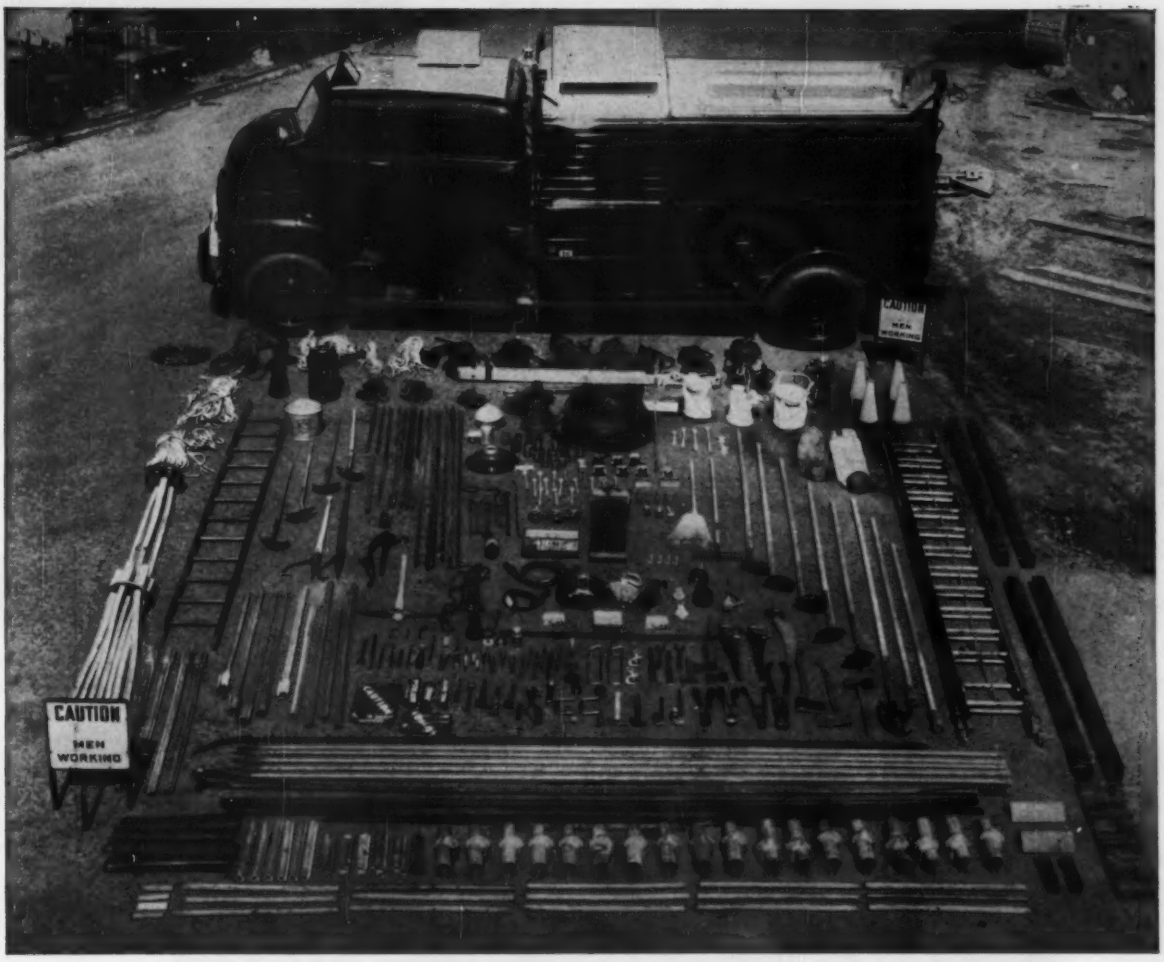
4 **Hotpoint Air-Blower Dryers** ... with plug-in flexibility! One connection for either 115V or 230V operation. Air-Blower models have giant Wide-Screen Lint Filter for increased drying efficiency.

2 **Hotpoint Sealed Chamber Dryers** ... no venting required! Ideal for installation in either utility room or kitchen. Cold water spray condenses moisture and the lint and water are pumped down the drain.

LOOK FOR THAT Hotpoint DIFFERENCE
(your customers do!)

LIVE BETTER ELECTRICALLY

Automatic Washers • Clothes Dryers • Combination Washer-Dryers • Electric Ranges • Refrigerators • Food Freezers • Air Conditioners
Customline • Dishwashers • Disposalls • Water Heaters • Television • HOTPOINT CO. (A Division of General Electric Company), CHICAGO 44



Look at your line truck equipment needs from this angle . . .

Here's a poles-eye view of a typical utility line truck showing the wide variety of construction and maintenance tools and safety equipment your linesmen need for most day-to-day jobs. But—without exception—each and every item shown can be ordered conveniently from your nearby Graybar office or warehouse . . . and in every case you get the type and quality needed to assure speed and efficiency on the job *plus* long years of satisfactory service. All are products your linesmen know and respect—products that have been tried, tested and proven in the field by scores of companies just like your own.

Remember, when you order "via Graybar", you save the time and expense of multiple inquiries, for you can select, from this single source, the items best suited to your needs from among the products of over 200 of the nation's leading manufacturers.

Graybar is thoroughly familiar with utility requirements. Further, your nearby Graybar Representative stands ready to help as a convenient source of information on everything needed for pole-line construction and maintenance. And should you be faced with an out-of-the-ordinary problem, call on the experience of a Graybar Outside Construction Specialist for a consultation. We'll welcome your inquiry!

511-92

CALL GRAYBAR FIRST FOR . . .

Graybar Everything Electrical

GraybaR ELECTRIC CO., INC.
420 Lexington Ave., New York 17, N. Y.

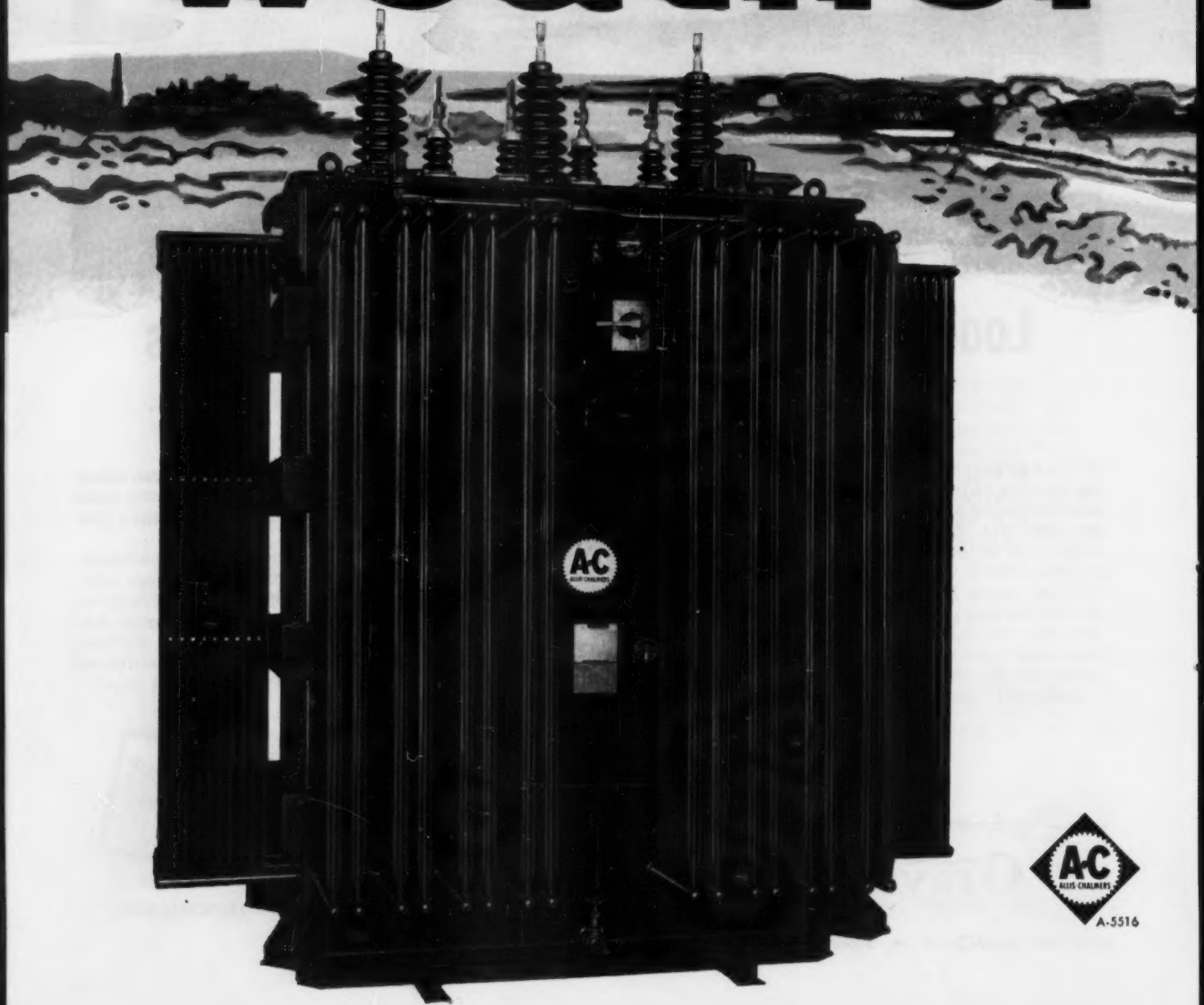
IN OVER 130 PRINCIPAL CITIES

...Attention to **CONSTRUCTION** detail adds years to transformer life... reduces maintenance

Submerged arc welding machine welds tank sections together in a smooth, liquid-tight seam. In other welding operations, giant "mechanical hands" position tank so arc welding is performed downhand for maximum strength. Size of fillets, exact locations, electrode and heat specifications are all determined by design engineers.

ALLIS-CHALMERS power transformers are

weather



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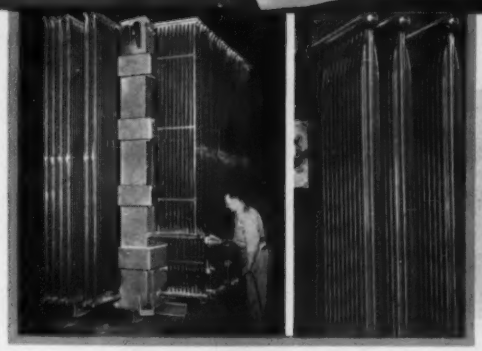


Welded-on radiators save time and money by simplifying installation. After welding is completed, transformer is sealed and pressure tested under extreme conditions. Fewer parts reduce maintenance. Nooks and corners where dirt and corrosion get in their destructive licks are eliminated.

Perfect seal provided by gasketing method for bolted cover. Gasket seat is accurately formed to confine the cork Neoprene gasket and control its compression. Welded cover is also available. Domed cover sheds water, to lengthen life of protective paint.

-tight

Balanced Design means

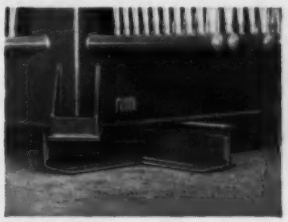
MORE for your Transformer Dollar

Weather-tight construction is another of the many features that make up the balanced design of Allis-Chalmers power transformers . . . features such as corona-free design, high impulse strength, uniform cooling, high short-circuit strength, reduced size and weight and many, many other features.

With power demands continually increasing, it is more important than ever to get assurance of dependability and long transformer life. For all the facts, call your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

Check these conveniences too!



Ample jacking space makes installation quick and easy. Practically any type jack may be used.

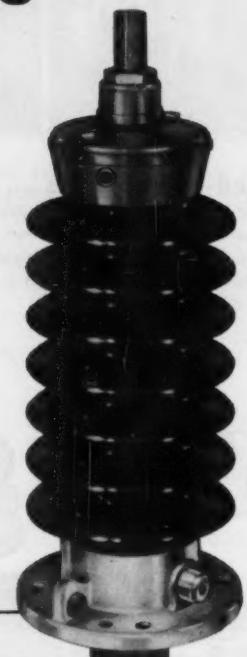
Ski-shaped base of heavy I-beam cross supports makes it possible to skid transformer in any direction.

LAYER-AFTER-LAYER

OF RELIABILITY GOES INTO

LAPP POC* BUSHINGS

FOR YOUR SYSTEM



Lapp POC* Bushings conform to ASA Standards. The small diameters specified by these standards permit design of new transformers and circuit-breakers of lighter weight, smaller size . . . and by use of inexpensive adapters, provide broad interchangeability for replacement in old equipment.

Lapp's solution to this reduced-diameter requirement is the POC* Bushing. In this design, a condenser series distributes voltage stress evenly and safely throughout the insulation. The condenser core is wound, as shown below, of multiple concentric layers of high-dielectric paper, interleafed with spaced aluminum foil layers. Paper is high-vacuum-impregnated and surrounded with oil, and the entire paper-oil core totally enclosed; the porcelain shank will not track or deteriorate under leakage current caused by contamination of equipment tank oil.

Paper-oil insulation ranks first in reliability as insulation for highest voltage cables, potheads and bushings. Lapp uses it in POC* Bushings at all voltages from 15kv up. Won't you sleep better with their extra safety margin protecting *your* system?

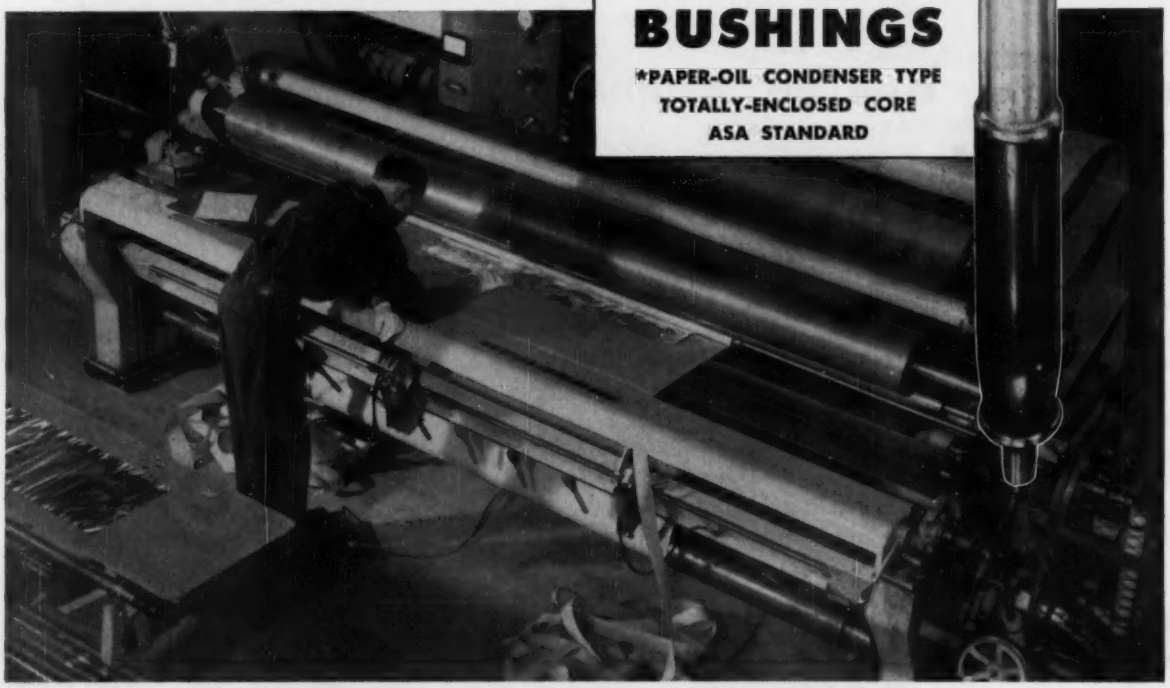
Lapp Insulator Co., Inc., LeRoy, N. Y.

Lapp

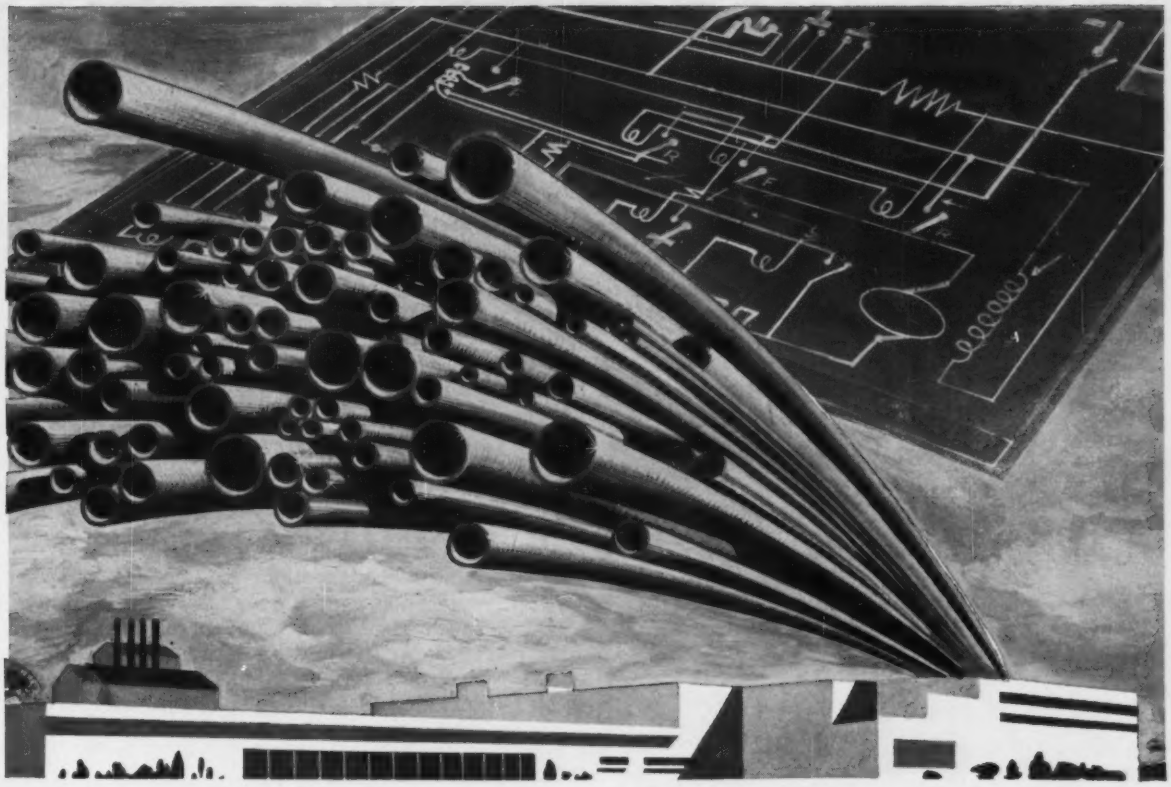
POC*

BUSHINGS

***PAPER-OIL CONDENSER TYPE**
TOTALLY-ENCLOSED CORE
ASA STANDARD



Naugatuck KRALASTIC



Kralastic conduit cut labor cost 82%

In a West Coast plant construction job, 15,060 feet of Kralastic® thermoplastic pipe were laid as electrical conduit and covered with 53 yards of concrete in only 116 man-hours... 82% less than if metal conduit had been used! Additionally, 24% was saved in cost of materials!

One man required but 20 minutes to make permanent, water-tight connections to 24 conduits installed in an excavation. This was possible only because Kralastic pipe can be cut with a hacksaw and solvent-welded, using sleeve-type joints, completely eliminating time-consuming threading operations and wrench work.

The light weight of Kralastic pipe (one-eighth that of steel) enabled a man to carry on his shoulder as much as 1,000 feet of 1½-inch pipe at one time, greatly facilitating its distribution and handling. Other advantages of Kralastic conduit are that it cannot rust or corrode, is not subject to electrolysis, and has a hard, smooth inner surface that makes wire pulling easy.

Kralastic pipe, up to 6 inches in diameter, is made and sold by leading plastic pipe concerns throughout the country. If not available in your community, write us for the name of the manufacturer nearest you. Remember, there are other types of plastic pipe... but Kralastic conduit pipe is in a class by itself!

United States Rubber

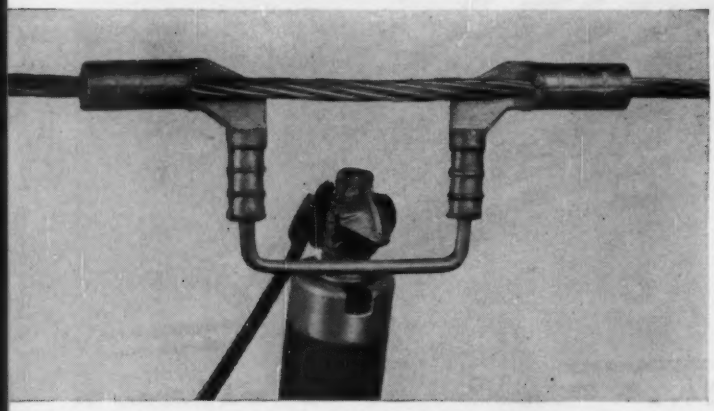
Naugatuck Chemical Division 230 Elm Street Naugatuck, Connecticut

Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices

DIST. OFFICES: Akron • Boston • Gastonia • Chicago • Los Angeles • Memphis • New York • Phila. • **CANADA:** Naugatuck Chemicals, Elmira, Ont. • **CABLE:** Rubexport, N.Y.

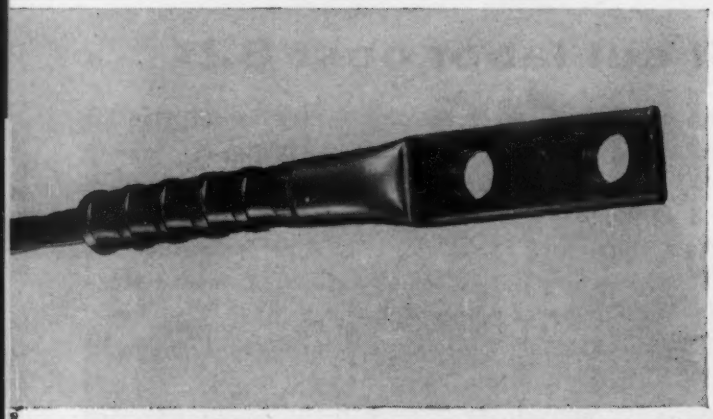
Kearney's compression program

Added versatility and increased application with existing tools—that's what an investment in Kearney Compression can mean for your system. Besides the basic connections—Squeezons, Serv-En Service Entrance Sleeves, Tension Sleeves and others—you receive the advantages of ever widening tool flexibility as Kearney Engineers continue to develop and introduce new Compression Fittings to the field.



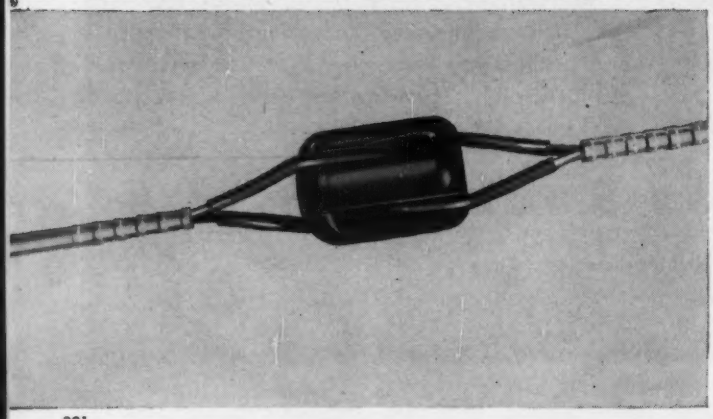
KEARNEY L Squeezon Stirrup

Line side connections are outside the basket—sufficient clearance for either the hydraulic or mechanical tool. The three inch dimension between the line and stirrup makes the unit neat and compact—hot line clamps are readily installed. Unit may be completely covered with line guards.



KEARNEY Compression Terminal

Kearney Compression Terminals provide an efficient method of connecting aluminum conductors to terminal pads. Flaring of strands possible with conventional terminal pads is eliminated. The strands are retained in an aluminum sleeve. Terminals have NEMA 1¾" bolt centers. May also be used as disconnectable jumpers around double dead-ends. The sleeves are filled with Kearnalex Contact Aid and capped and will take conductor sizes from 1/0 to 397.5 MCM 18/1 ACSR.



KEARNEY Insulated Splice

The Insulated Splice was designed primarily for splitting secondaries into shorter sections where additional transformers have been installed and for series street lighting applications. No changes in existing construction are required. Designed for copper, aluminum and ACSR connections, this splice features one piece construction, tension-type sleeves, insulated stainless steel bails and a high strength strain insulator. Splice can be installed with Kearney Hydraulic or Mechanical Tools. ACSR and aluminum sleeves are packed with Kearnalex Contact Aid and plastic capped.

391

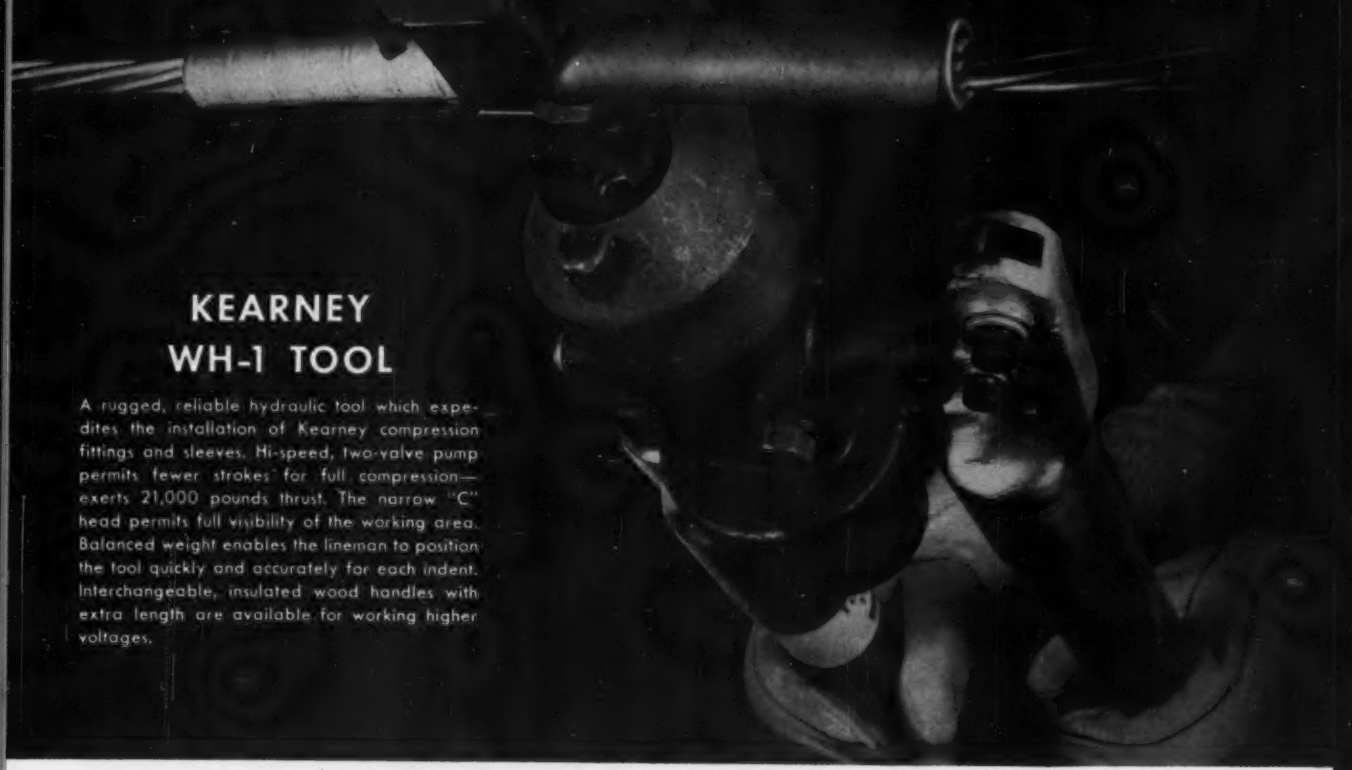
pays extra dividends

KEARNEY INSIDE TAPERED COPPER SLEEVE

A completely new, cost-cutting design—another Kearney "dividend"—permanent, positive, full tension splicing of energized conductors with standard Kearney tools and dies.

ADVANTAGES—

1. **Metallizing process**—copper sleeve is sprayed internally with conductive metal to assure maximum holding power and high conductivity.
2. **Full Inside Taper**—design assures ease of insertion of hot conductors—also relieves stress, due to vibration, at the extremities of the sleeve.
3. **Shorter Length** means less installation time, fewer crimps and no sacrifice of holding power—sleeve is more easily stored.
4. **Clearly marked** with conductor and die sizes.



KEARNEY WH-1 TOOL

A rugged, reliable hydraulic tool which expedites the installation of Kearney compression fittings and sleeves. Hi-speed, two-valve pump permits fewer strokes for full compression—exerts 21,000 pounds thrust. The narrow "C" head permits full visibility of the working area. Balanced weight enables the lineman to position the tool quickly and accurately for each indent. Interchangeable, insulated wood handles with extra length are available for working higher voltages.

FOR BETTER CONSTRUCTION—SAFER MAINTENANCE

Specify Kearney Products

PLANTS AT: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

PREFORMED ARMOR RODS
increase uninterrupted service life of conductor

The wind blows, the conductor vibrates and the life of your line is at stake. If the vibration problem is such that severe frequency and amplitude conditions are sufficiently prolonged, the conductor could begin to break regardless of the protective armor used. And, if the conductor begins to break, PLP Preformed Armor Rods have a big advantage over other armor: The rods undertake the function of an electrical and mechanical repair splice.

All armor rods greatly reduce vibration stresses, but if vibration is severe enough to cause strand breaks, other types will not prevent parting of the strands. With PLP (short pitch) Preformed Armor Rods, it's a different story; the conductor is held tightly and uniformly throughout the entire length of the rods—not at one point. You have a long, firm grip that never relaxes, that maintains conductivity in spite of the break. Thus, your line continues to function unimpaired.

There is one other Preformed advantage to keep in mind. Some types of armor require the use of bolted end-clamps that can shake loose and cause chafing. Preformed Armor Rods require no end-clamps.

For a long uninterrupted service life, Preformed Armor Rods are the best suit of armor your conductor can wear. PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland . . . in 10 years the leading manufacturer of armor rods, dead-ends, Guy-Grip dead-ends and other line accessories.

PLP

You can look up to **Preformed**

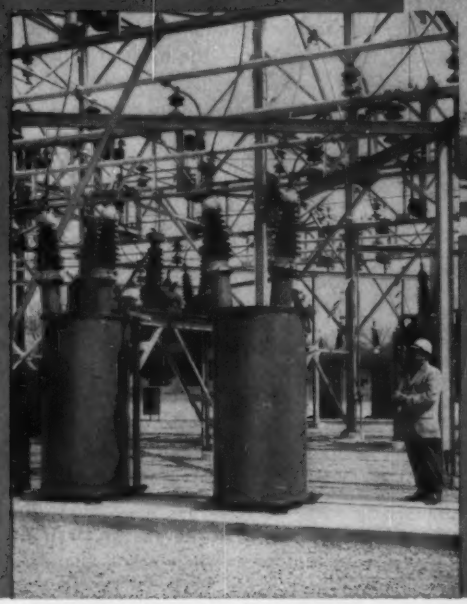
Made in accordance with or for use under U. S. Patent Nos. 2,609,653; 2,275,019 and 2,587,521. Other patents pending.

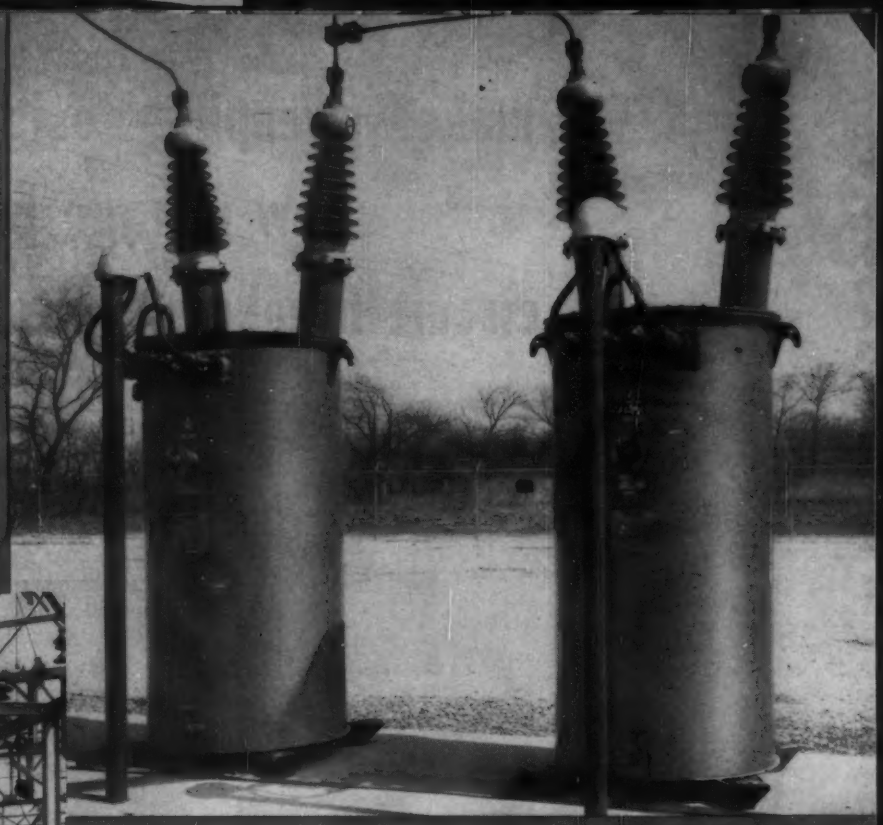
For its own

SUBSTATION

POWER

CONTROL . . .





LONG ISLAND LIGHTING CHOSE HIGH VOLTAGE

Pole Star

DISTRIBUTION TRANSFORMERS

There is no other type of distribution transformer installation in which reliability is so vital. In this case, not just a few homes or commercial establishments are involved—but rather, operation of the entire Ruland Road Substation of Long Island Lighting Company, which ties a new 138-kv feeder into a 69-kv feeder.

Long Island Lighting chose four high voltage Pole Stars for this important installation, which provides "control power" for the fans, pumps, and tap changer of the main substation transformer, for the heaters and battery chargers of the switchgear, and for station lighting. The Pole Stars are 100-kva, 67-kv units connected as two open delta banks. The low voltage is 120/240 volts.

Pole Stars have won a fast-growing reputation for dependability in high voltage applications because they possess the *ruggedness* that is needed for day-in-day-out operation. For more details or a quotation on that next order, contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW EDISON

Pole Stars are available in all standard single-phase sizes from 3 through 500 kva, through 67,000 volts.

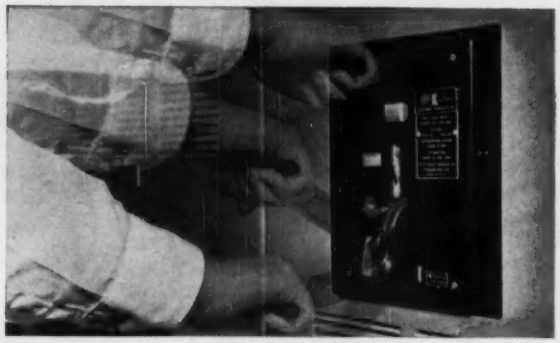
PENNSYLVANIA POLE STAR TRANSFORMERS

PENNSYLVANIA DISTRIBUTION TRANSFORMERS

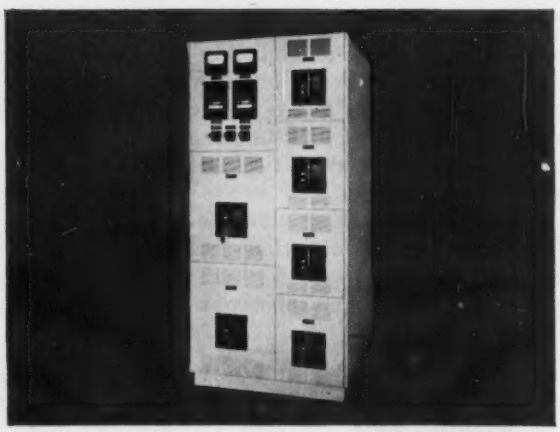
I-T-E makes sweeping design advances in new low voltage power circuit breakers, switchgear

I-T-E's new K-Line offers better performance, greatly simplified operation and servicing, and standardization in construction and assembly

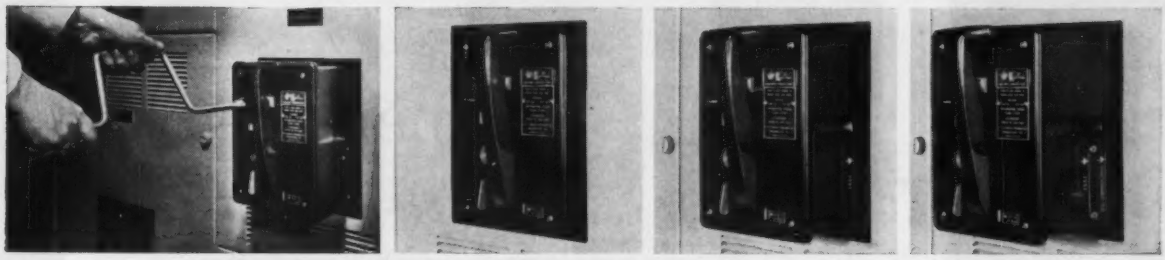
Now we offer a complete new design of equipment for the switching, control and protection of motor, generator, transformer and feeder circuits, as well as other large electrically powered facilities—the most sweeping design advance in 13 years. Among the major innovations in the new design are the following.



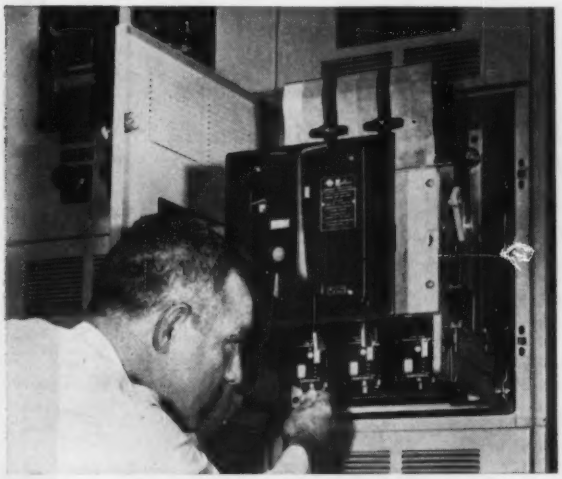
First quick-make manually charged stored energy closing mechanism. First 90% of pulldown handle travel charges spring mechanism, last 10% releases stored energy, automatically closes contacts. No teasing of contacts is possible.



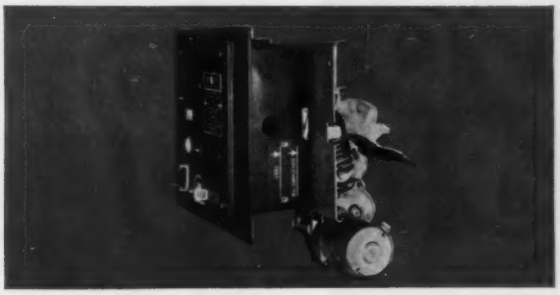
4-high stacking of 600 amp frame size circuit breakers in 90-in.-high enclosures. The new circuit breakers are as much as one-third smaller and 55% lighter than comparable units. The new switchgear is the smallest ever designed.



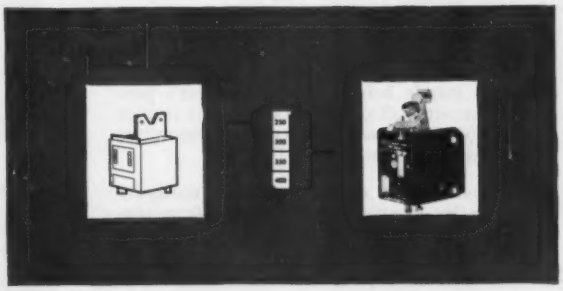
First closed-door drawout of circuit breakers. This permits racking of circuit breaker into connected, test and disconnected positions without opening the door of the circuit breaker compartment. Drawout arrangement keeps circuit breakers clean, aisles uncluttered, promotes personnel safety. Breaker must be opened before shutter can be lifted to insert drawout racking crank. Breaker cannot be closed while shutter is lifted.



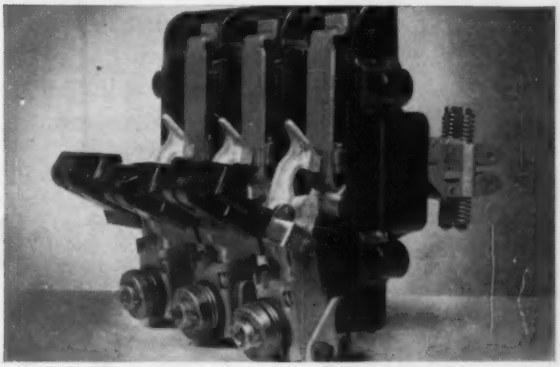
Greatly increased accessibility to component parts for operation and servicing. For example, trips on electrically and manually operated breakers are out in the open and can be easily adjusted. Trips also can be changed quickly. One-piece molding holds trip units, which are changed from the rear and in a fraction of the time formerly required.



Stored energy electrical closure that materially cuts control circuit requirements. The motor-driven stored energy system requires only 10 amp from a simple power source, compared to as much as 160 by comparable solenoids. Quick-make manual closure operates on same principle. First 90% of pull-down handle travel charges a spring mechanism. Last 10% releases the stored energy and closes the contacts. No teasing.



Expanded trip flexibility meets last-minute load changes in many instances with the existing trip unit.



Subassembly circuit breaker construction permits easier, faster replacement of parts. Six major subassemblies replace 130 separate parts in previous models. A part replacement formerly requiring an all-day overhaul of the circuit breaker may mean only removing and replacing a unit subassembly—a matter of minutes.

Bulletin 6004C tells the complete story of this advanced design switchgear. Ask your local I-T-E representative for a copy today. Or write I-T-E CIRCUIT BREAKER COMPANY, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E

I-T-E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STREETS, PHILADELPHIA 30, PENNSYLVANIA

Note this Nameplate Carefully—

TOOL OPERATED DISCONNECT

CAT. NO:	4752	KV, NOMINAL:	15
KV, MAX. DES:	15	KV, IMP. WITH:	95
AMP, CONT:	400	AMP, MOM:	20000

This is an S&C Tool Operated Disconnect. Used with S&C's Loadbuster, it can switch the circuit under any condition except short circuit—without external arcing.

U S PATENTS PENDING

S&C ELECTRIC COMPANY
CHICAGO

Made in U. S. A. G-3448

S&C ELECTRIC COMPANY

It means—

1. universal low cost load switching throughout your distribution system by use of LOADBUSTER®, the portable loadbreak tool; for loads up to 400 amperes and with system voltages through 14.4 kv;

2. station-type disconnect performance at distribution disconnect prices;

3. S&C stands behind this disconnect's performance with full published short-time ratings and insulation values—values which cannot be matched in the distribution field;

4. an inexpensive device for duties normally handled by group-operated disconnects, station-type stick operated disconnects, and conventional load interrupters.

Now look how Loadbuster works

Attached to a universal pole, LOADBUSTER is simply hung on the attachment hook of this new Tool Operated Disconnect, and the pull ring hook inserted in the pull ring. As the pole is pulled downward the disconnect is opened, LOADBUSTER trips, breaking the circuit positively. It's that easy!

S&C Electric Company, 4421 Ravenswood Avenue, Chicago 40, Illinois.
In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

The News-Scope

LATE NEWS ▶ **AIEE nominates L. F. Hickernell (Anaconda W&C) as 1958-9 president** at Winter General Meeting. Nominated as VP's were L. C. Holmes, J. R. Kerner, R. B. Gear, I. T. Monseth, J. M. Nelson, N. F. Rode, and E. C. Starr. C. H. Linder was nominated as treasurer.

Vallecitos boiling water reactor ups power output 50% from its designed 20,000 kw, "without change in design or addition of fuel."

Prefabricated power plants reportedly have been developed in Czechoslovakia. The 1,500 and 750-kw plants can be fired with wood, coal, or fuel oil. Only "simple building" on concrete base is needed.

Seven Pacific Northwest utilities sign 50-yr contracts with Bonneville Power Administration for use of BPA grid to wheel Priest Rapids power to their areas. First delivery: April, 1959.

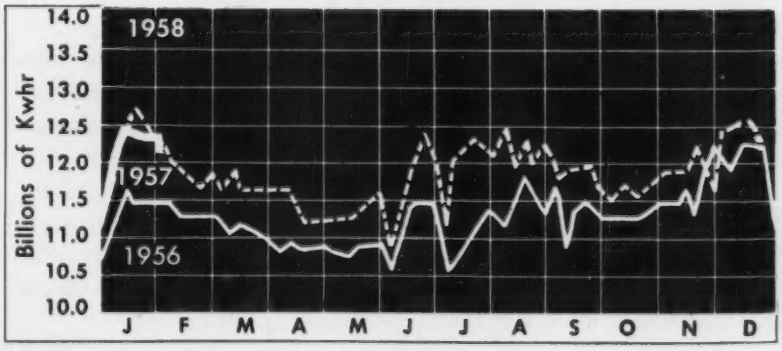
NRECA's Gen Mgr Clyde Ellis charged at last week's Dallas meeting that Ike had "double crossed" REA co-ops by **requesting $150** million for new loans when they would need $210 million in fiscal '59.

Management changes . . . Montana Power ups W. D. Eminger to superintendent of generation . . . L. C. Hansen is new **VP-marketing** and J. T. Isbell new assistant to the president of A. B. Chance Co.

FUTURE NEWS ▶ **Big push for TVA-financing legislation is coming.** Proponents now holding "strategy sessions." Senate-passed bill, and one awaiting House action, would let TVA initiate projects without congressional approval. A watered-down version is expected to pass.

Despite all the pessimism about nuclear power costs, 1958 will see a few more nuclear power plant proposals, especially from the West.

Power Output—Down 0.7% (Week ending Feb. 1), Kwhr 12,238,000,000



Per Cent Change From Previous Year

	Jan. 18	Jan. 25	Feb. 1
Total U.S.	−1.2	−0.1	−0.7
New Eng.	−1.3	+0.7	+0.7
Mid. Atlan.	−2.0	−0.1	−1.7
Cent. Ind.	−4.4	−2.6	−3.1
West Cent.	−2.2	−0.3	−1.2
Southeast	+0.8	+3.0	+5.0
South Cent.	+2.9	+2.8	−0.3
Rocky Mount.	+2.7	+2.7	0.0
Pacific			
NW	−5.9	−7.6	−7.7
SW	+4.9	+2.4	−1.4

Seasonally Adjusted Index 227.5

Week Ago 227.4 Year Ago 229.5

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output decrease was 0.1%

The Electrical Week

EVENTS ▶ **With a spirit of unabashed optimism,** the electric utility industry is forging ahead into an era of growth, despite drag of the current recession. This view comes from six utility leaders as they make a comprehensive round-up of their respective regions **(p 43).**

New England's power future is keyed to research and research-born industries, says Western Massachusetts Electric Pres. H. J. Cadwell.

Pacific Northwest electric suppliers need to spend $1 million a day till '68 to keep up with demand, predicts Montana Power's Corette.

The upper Midwest's recent spurt in growth may be the beginning of a "second industrial revolution", claims report of NSP's King.

Southwest's natural resources are bringing well-diversified growth to the area and to the power field, says Oklahoma G&E's Kennedy.

The Rockies show no sign of slackening their fast pace in industrial growth and utility construction, reports Utah P&L's Naughton.

In the Southeast, the electric industry is expanding more rapidly than in the nation as a whole, says Southern Co's Harllee Branch.

National Electrical Week swings into its third—and best—annual celebration with varied and original programs by the nation's electric utilities **(p 40).**

WASHINGTON ▶ **FPC settles final problem in long-standing Niagara controversy—**the cut-and-cover conduit problem—thus clearing the way for construction of the 1,800-Mw power project. For full details of EW's wrap-up, see **p 42.**

A 50 to 100% hike in spending for basic atomic research is called for as AEC and Joint Committee on Atomic Energy begin annual joust over AEC's progress in peaceful uses of atomic energy **(p 42).**

Rep Engle's clever strategy delays death blow to Hells Canyon federal power project. Issue, which has been gradually dying despite proponents' efforts to revive it, is postponed to June 2 **(p 42).**

Outlook for partnership program at Trinity is touch-and-go as date for critical House vote nears. If successful, next step would be hearings before bipartisan Senate Interior Committee **(p 42).**

RELAYING ▶ **Do you sometimes lose circuits** because of carrier-equipment's "fail-safe" nature? If so, here's a system that will help you ward off unnecessary line tripping. It's a team of two electronic robots—a check-back unit and a master-check unit. The check-back unit tests carrier equipment at remote substations when commanded to, either by an operator at an attended substation or by the master-check unit. The master-check unit will order a test every 8 hr, and if the check-back unit finds trouble, the master-check unit alerts the attended substation's operator promptly **(p 51).**

PLANT ENGINEERING ▶ **Want to know how an A-plant works?** A nuclear engineer gives a short course on the differences between today's reactor station and the conventional plant—control systems, instrumentation, safety systems, and auxiliary circuits for "scramming" **(p 47).**

INDUSTRIAL ▶ **Detroit Edison solves the mystery of the suburban plant outages** by tracing rising rate of interruptions to super-sensitive controls on the plants' automated machinery. For the complete story on how the industrial customers modified the controls, see **p 56.**

MANUFACTURERS ▶ **An ultrasonic thickness gage saves lead and money in Okonite Co's** production of lead-sheathed cable—improving cable quality at the same time . . . A 7,500-kva, 69-kv mobile substation from Allis-Chalmers goes on duty at Texas City **(p 106).**

NEW EQUIPMENT ▶ **Complete substation with automatic recloser now comes packaged** for use in rural areas, small towns, and outlying industrial plants. It's used with pole-mounted disconnects . . . New oil switches can interrupt 400-amp lagging current at all pf down to 10% **(p 81).**

SELLING ▶ **Mr and Mrs Consumer gape at all-electric home,** new electric and electronic gadgets as Chicago's gigantic 1958 appliance and home show admits public for first time. Aim of new "open-door" policy: To pre-sell the consumer for manufacturers and dealers **(p 70).**

HEATING & COOLING ▶ **There'll be no more icy milk in winter or curdled cream in summer** for one Milwaukee dairy. Reason: It has installed modern heating and cooling equipment in its delivery trucks. Heating units should also stop truck stalling in winter . . . Cold weather work slowdowns in a St. Louis sugar plant have ended since the firm wrapped electric heating cable around a pipeline carrying caustic solution **(p 74).**

MANAGEMENT ▶ **Southwestern PS can upgrade an employee to engineer's Man Friday** in 16 weeks through concentrated engineering estimator course. The new program, which covers wide range of subjects, was inaugurated to free engineers from routine technical tasks **(p 54).**

TAXES ▶ **Accelerated depreciation benefits are divided** between company and customers in a new plan devised by analysts of the utility industry. Company gets to use tax savings as equity capital to help finance new construction. Customers get a percentage share of the savings credited against capital cost—which can lead to rate reductions **(p 97).**

PEOPLE ▶ **Raymond A. Gibson becomes president** and A. D. Barney board chairman of Hartford Electric Light . . . Phelps Dodge Copper ups E. P. Dunlaevy to executive VP, S. A. Jacobs to president of Inca Div.; J. J. Conlon, W. K. Dunbar, E. A. Mitchell to VP's **(p 108).**

Promotion budgets of western utilities will hit another high in '58. 80% of the executives of 41 utilities, which serve 84% of the electric customers in the West, say they'll boost promotion spending over that of '57. Few would give figures, but a selected group of private and public power utilities, serving more than 5 million customers, is planning to spend more than $11 million—more than $2 per customer.—**Electrical West, Jan 1958.**

An uncertainty factor of three in the cost of nuclear fuel has been revealed in a detailed study. A panel of eight experts estimated a maximum value of 6.2 mills per kwhr and a minimum value of 2.0 mills. The big range results principally from a spread in plutonium credits and fabrication charges. By being optimistic about everything except the price of Pu, the experts concluded that nuclear fuel costs will not be competitive until burnups of 15,000 megawatt-days per ton are achieved (study used 7,500 Mwd/ton)—**Nucleonics, Jan 1958.**

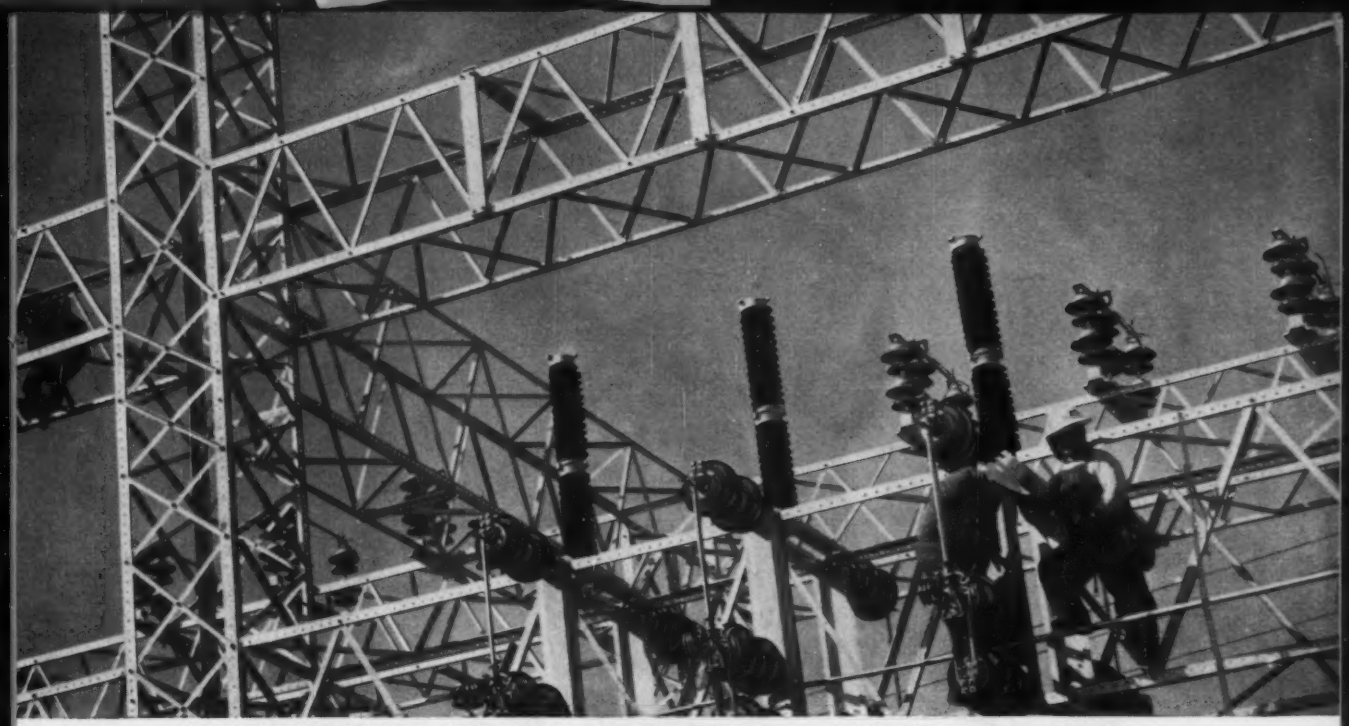
Use of voltage regulators, capacitors, or boosters on a distribution circuit seems preferable to changing taps on distribution transformers as an emergency corrective of low voltage. Prompt conversion of the distribution system to a standard voltage is preferable to continuing the purchase of odd-ratio transformers or standard ones with taps to match the non-standard system voltage. Extending the standardization of non-tapped ratings should bring substantial savings to manufacturers and users alike.—**H. M. Jaloneck, Transmission & Distribution, Jan 1958.**

TECHNICAL NOTES

Reliability of electron tubes can be improved by eliminating variables caused by materials collecting on the grid and anode electrodes. Clean electrodes can be obtained by using active metal surfaces and high degassing and exhaust temperatures. They can be maintained clean for long periods by using with them only oxide-coated cathodes having a passive base metal.

Military emphasis on missiles spurs new drive against RI. Reason is fear that radio "noise" emanating from electrical and electronic aids to modern living can misguide or prematurely fire missiles.

Oxygen, instead of air, is being used for coal gasification by the Russians. This is claimed to produce gas of richer quality. An open borehole method with a continuous through channel is used.



THREE-PHASE INSTALLATION of L-M's new Ultra-Valve arresters, rated 60 kv maximum, in a 69 kv substation. The arresters are light and compact, and have outstanding electrical characteristics.

With Simple Series Gap and Valve Disc Design,

New Ultra-Valve Intermediate-Class Arrester Is Exceptionally Rugged, Durable, Light, Compact

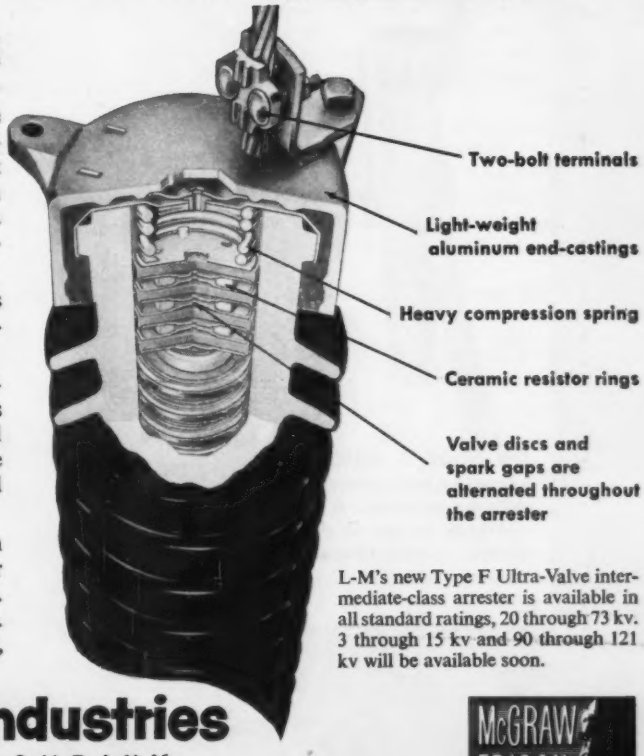
Line Material engineers have developed a new, light, compact intermediate-class arrester that features rugged simplicity, exceptional durability and excellent protection.

These new Ultra-Valve arresters are easy to handle from receiving dock to job site, because they are decidedly lighter and more compact. Reduction in height has been achieved without a corresponding sacrifice in desirable external creepage distance, by providing a number of relatively deep skirts on the external housing surface.

The unusually rugged, simple construction minimizes the possibility of concealed damage caused by inadvertent rough handling in shipment or installation.

L-M's new Ultra-Valve arresters are capable of meeting the minimum discharge capacity and duty cycle tests for station-type arresters, as listed in ASA Standard C62.1-1957. These arresters provide excellent protective characteristics and are presently available in standard voltage ratings from 20 kv to 73 kv inclusive.

Ask your L-M Field Engineer for more information on how L-M's new Type F arrester can provide greater lightning and switching surge protection on your system. Or write Line Material Industries, Milwaukee 1, Wis. In Canada, Canadian Line Materials, Ltd., Toronto 13, Ontario.


Two-bolt terminals
Light-weight aluminum end-castings
Heavy compression spring
Ceramic resistor rings
Valve discs and spark gaps are alternated throughout the arrester

L-M's new Type F Ultra-Valve intermediate-class arrester is available in all standard ratings, 20 through 73 kv. 3 through 15 kv and 90 through 121 kv will be available soon.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

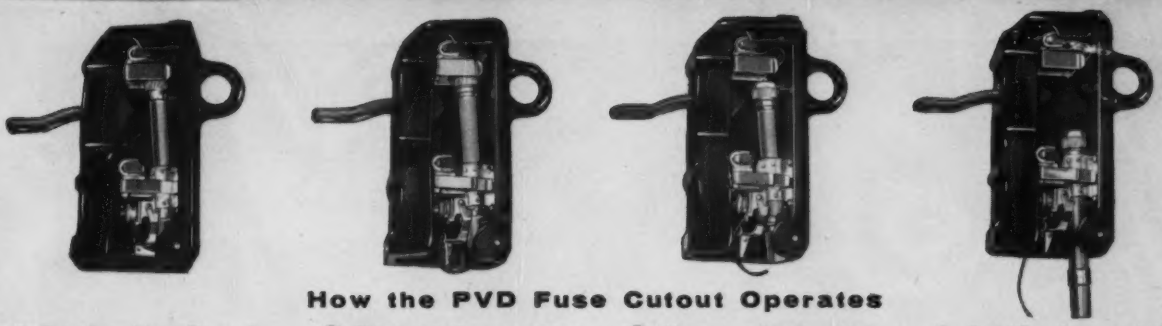
Lightning Arresters

McGRAW EDISON

329

DOOR IS EASY TO OPEN. Handle is high up on the door to assure good leverage, and hole is large enough to insert hookstick easily, yet small enough so hook will not slide down or jump out. Available in standard-duty ratings and new heavy-duty interrupting ratings of 5000 amps. at 5.2 kv and 8000 amps. at 2.6 kv.

THE DOOR IS REMOVED, unhooked, and replaced, all with the hookstick. A special hook on the door assembly makes this convenient.



How the PVD Fuse Cutout Operates

1. Fused position. Door always closed—operation is independent of door. As the link blows, spring-loaded lever flips out the fuse link leader—fast!

2. This instantly separates blown link parts, clearing the arc inside the tube. It also releases a latch which permits the bright yellow fuse tube to drop out.

3. Upper spring contact pushes the tube down and follows it part way, giving extra time to clear the arc, and eliminating burning of contacts. Action is positive.

4. Cartridge drops to indicating position easily seen from the ground. Large air gap prevents re-establishing the arc. No leakage, no radio interference.

How L-M's Famous PVD® Cutouts Provide Faster, Safer Operation

Positive dropout operation provides indication easily seen from the ground. For re-fusing, door is easily removed and replaced with hookstick; high-pressure silver contacts insure long life. Now also available in heavy-duty designs.

By **GEORGE W. COOPER**
Product Manager
Protective and Power
Switching Equipment
Line Material Industries

When a fuse blows in L-M enclosed dropout cutouts, a latching lever flips out the fuse and permits the cartridge to drop to indicating position. Upper contact spring follows tube part way, giving extra time to clear arc inside the tube. Contact spring also provides a downward thrust on the tube to assure positive dropout operation.

The large air gap which results between the tube and the upper contacts on the box prevents re-establishing of the arc. This assures long service, eliminates leakage and possible radio interference. Door remains closed following fuse operation; parts are always protected.

Positive Low-Resistance Contact

L-M's silver-plated spring contacts and round blade provide a very high-pressure, multi-point contact surface. In addition to the side contact clips, the spring-top clip provides additional contact and current path.

L-M's heavy contact construction provides ample metal to conduct heat away rapidly from the multi-point contact surface. This results in cool operation, and resistance is kept low.

Blown Fuses Easily Located

When the cartridge in L-M's enclosed cutout is in indicating position, it is easily seen from the ground—from any angle. The lineman locates the blown fuse quickly; thus he saves operating time and restores service faster.

Easy To Re-Fuse With Hookstick

The pull ring handle on L-M's PVD cutouts is high up on the door to assure good leverage when operating the door. This, plus a hook on the flipper assembly, make it easy to open and unhook the door, and to replace it with a spare fused door, the whole job being done with the hookstick . . . in just a few seconds.

In the open position, all parts of the door and cartridge assembly are electrically dead.

When the door is closed, the two hinges and the lower contact hold the door and cartridge assembly firmly. This, plus the guiding action of the top contact, assures that the door will close properly every time.

L-M Family of Dropout Indicating Cutouts

Interrupting Capacity Amp.	5.2/2.6 kv		7.8 kv	
	50 Amp.	100 Amp.	50 Amp.	100 Amp.
2000/3000	PVD			
3000/5000		PVD		
5000/8000	PHV*	PIV*		
2000			PVD	
3000				PVD

**New heavy-duty ratings*

In addition to the dropout indicating cutouts above, L-M offers a complete line of non-dropout indicating and non-dropout fuse cutouts.

Ask your L-M Field Engineer for more complete information, or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ont.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY
fuse cutouts and fuse links

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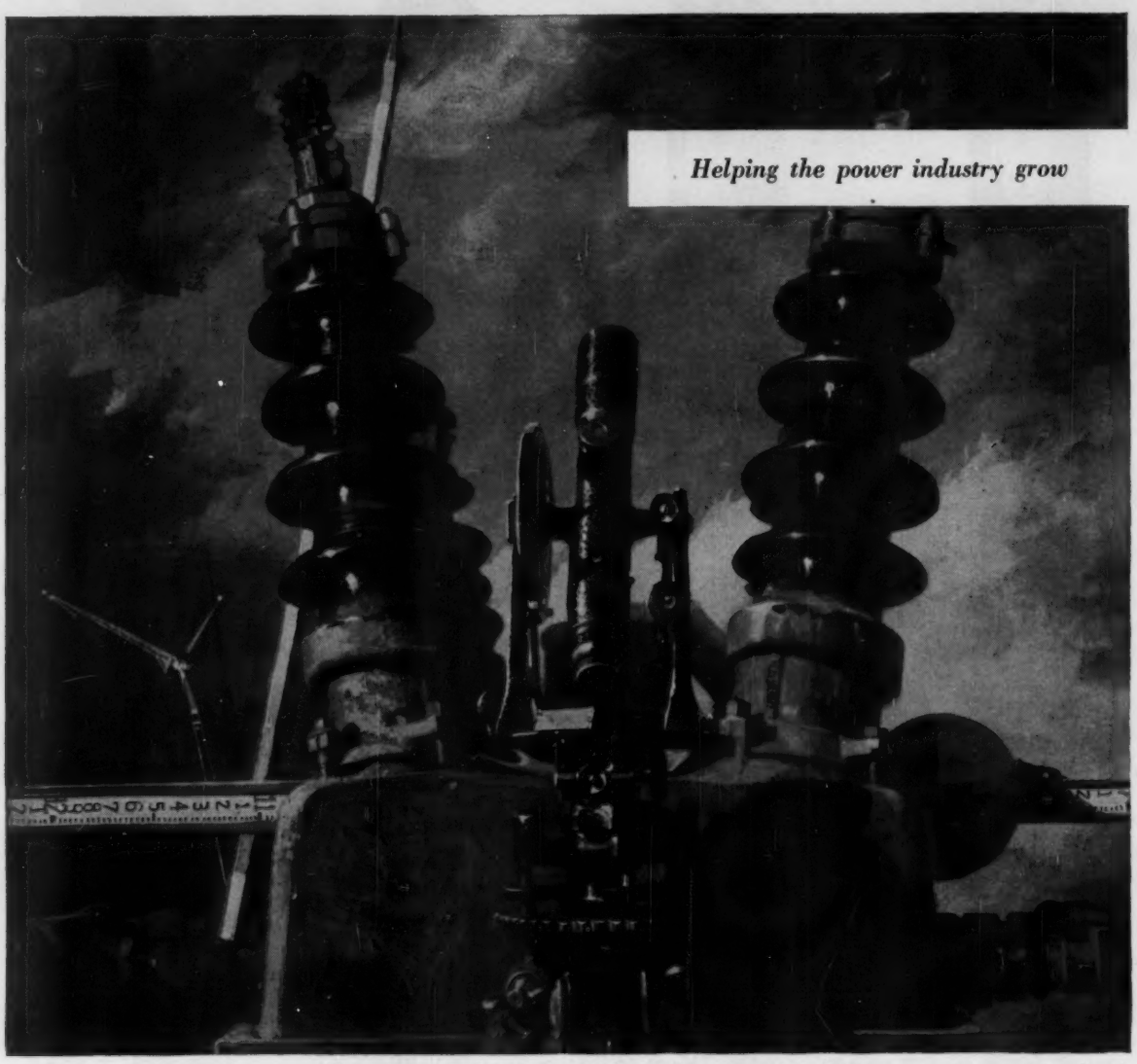


High-voltage ceramic insulators capable of holding tremendous electric power under control; transit and leveling rod; the slender arms of a swinging boom—these are combined by Stanley Meltzoff to tell the story of the growth and expansion so typical of America's responsible, progressive electric power industry.

Constructing in Five Dimensions

Many projects must be executed not only in the conventional three dimensions, but also within the inflexible limits of time and budget. Our skilled and experienced team has proved many times its ability to complete a project on schedule and at a cost both reasonable and controlled. The range of our services is broad and flexible; facilities can be adapted precisely to moderate or extensive needs.

We have served many of the country's leading utilities and industrial firms on such projects as thermal and hydroelectric plants, electric substations, and installations for supplying heating and process steam.

Our many new assignments from clients previously served speak for the caliber of our past performance. Our more than 70 years' experience assures you of maximum return on each dollar expended.

We invite you to share and profit from this background.

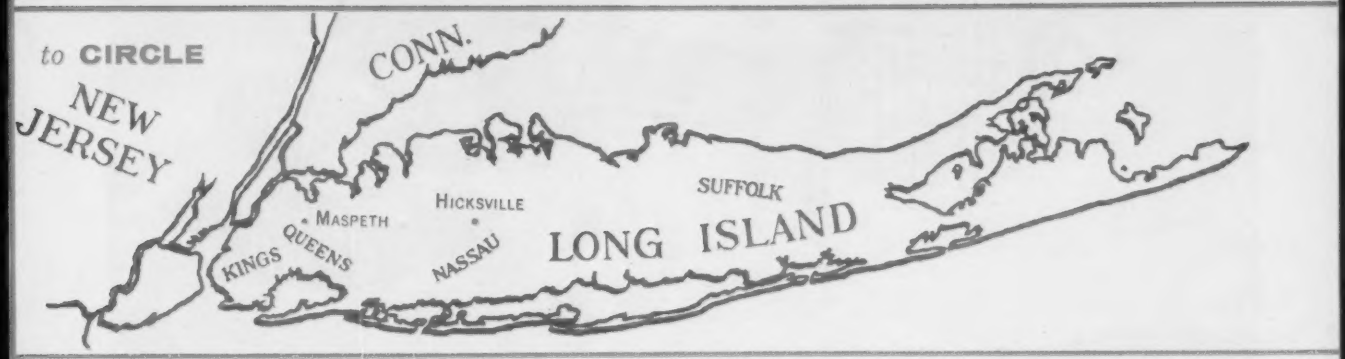
UNITED ENGINEERS

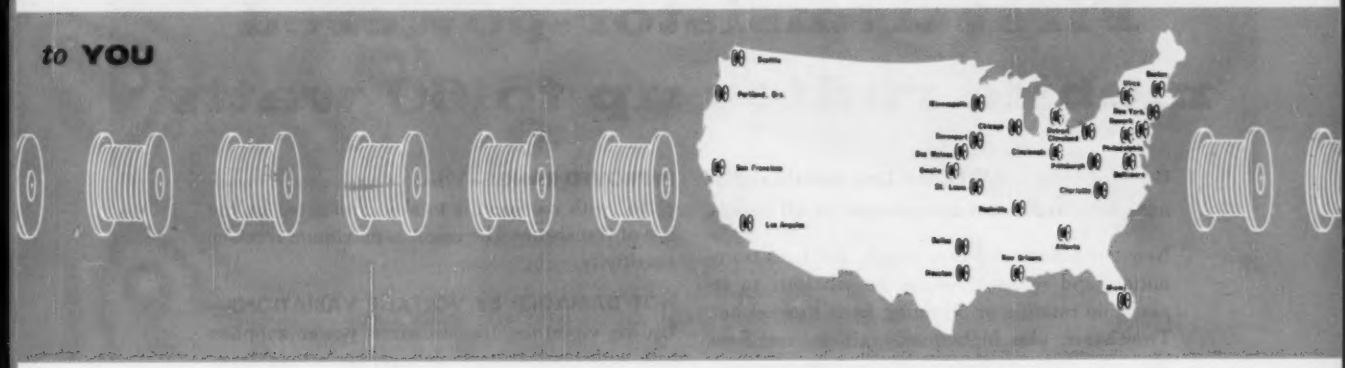
& Constructors Inc

U.E.&C. (Canada) Ltd.

Designers • Constructors • Consulting Engineers

New York • PHILADELPHIA • Chicago





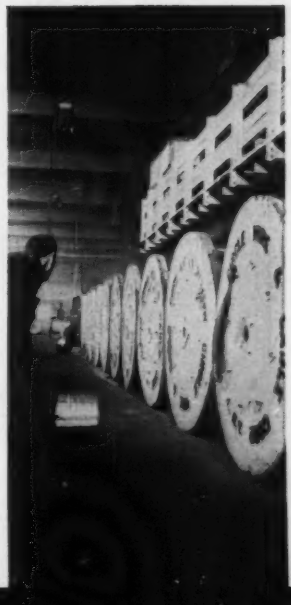
ONE SURE SOURCE OF SUPPLY

for all your wire and cable needs

One way to consistently turn out quality products is to control manufacture from beginning to end. Circle does. From Cerro de Pasco's own mines and smelters high in the Peruvian Andes come the refined copper, lead and zinc that go into Circle wire and cable.

At Circle's huge plants, these bars are converted into one of the country's broadest lines of quality building wire and cable. Strict controls insure that every foot of wire and cable is as perfect as can be before shipment to a vast country-wide network of distributors.

Quality line, ample stocks, all-out service: these are why more and more contractors agree that working through a Circle distributor is their best assurance of adequate, available supplies. Next time you need wire or cable, say Circle—many other satisfied contractors do.



CIRCLE WIRE & CABLE
a subsidiary of
CERRO DE PASCO CORPORATION

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES:** In all principal cities.
RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
NEOPRENE SHEATHED CABLES • "CIRTUBE" EMT

First transistor-powered mobile radios up to 60 watts

General Electric's Progress Line mobile radios now offer transistor advantages in all bands.

New transistorized power supply for both transmitters and receivers means no vibrators to replace, no rotating or vibrating parts to wear out. Transistors, plus high quality silicon rectifiers, give you the most dependable mobile communication known today.

Progress Line mobile radios with transistorized power supplies are available in *all* communication bands: 30 or 60 watts in low band (25-54 mc), 25 or 50 watts in high band (144-174 mc), or 15 watts in UHF band (450-470 mc).

OPERATE FROM EITHER BATTERY POLARITY—Only General Electric's Progress Line lets you operate on either positively or negatively grounded 12 volt batteries. This is especially important in fleet operations.

IMPROVED RANGE—Vibrator hash usually associated with receivers is totally eliminated by the use of transistors. The result is maximum receiver sensitivity.

NOT DAMAGED BY VOLTAGE VARIATIONS—Unlike vibrators, transistorized power supplies can withstand battery voltage variations from +20 to −50 percent.

PROGRESS WITHOUT OBSOLESCENCE—No need to buy new power cable or control head. General Electric Progress Line mobile units with either new transistorized power supply or regular vibrator power supply are *completely interchangeable.*

Call your G-E communications consultant for full details. He's listed under "Radio Communication Equipment" in the Yellow Pages. Or write General Electric Company, Communication Products Department, Section 9258, Syracuse, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

NO MORE WASTE when you cut a length of new SLIPKNOT #7 PLASTIC ELECTRICAL TAPE . . . and no more struggling to cut it, either. Because Slipknot's newly developed all-plastic tape cutter (pat. pending) rides the roll, and gives a quick clean cut when and where you want it. No more stretching and thinning the next several inches. Try new SLIPKNOT #7 with ZF-90 — Plymouth's formula for total adhesion — on your next job. You'll like it, and you'll appreciate the cutter, packed free* in every 66-foot can.

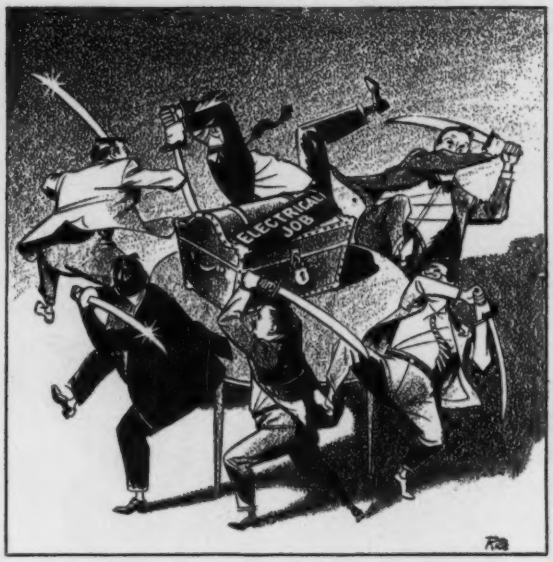
*Limited time offer

PLYMOUTH RUBBER COMPANY, INC.

Makers of SLIPKNOT FRICTION TAPE

DIVISION 19 CANTON, MASSACHUSETTS

Who's cutting whose throat?



THE "scourge of below cost bidding" continues to eat away at the contracting industry – *and this in a time of the greatest construction boom in history!*

Why? Shortage of electricians is chronic! Thousands are badly needed across the country to meet the mounting needs of commerce, industry and the mushrooming home modernization market.

Yet in spite of this, the industry seems caught up in a give-away mania that's leaving millions of dollars on the bidding tables.

Why? Well, several reasons. Some contractors underbid simply because they don't know their own costs. Others, possessed by an urge to keep up a big front, try to maintain volume at any cost. Still others underbid merely to squeeze out competition and wind up on top.

The fact is that any selling involving consistent price cutting is suicidal – a form of salesmanship that can only lead eventually to large losses and bankruptcy.

A Way Out

Any way out of the squeeze? Yes, there is! This year the Electrical Industry is spending close to $10 million to help drop a *multi-billion dollar* Adequate Wiring market right in the contractor's lap.

And make no mistake about it, this rewiring business can be the highest profit business on your books – plenty of contractors have already proved it.

They like it because it helps take them out of the price squeeze. When a contractor sells a homeowner, for example, on the idea of "living better electrically," the only way competition can beat him out is by selling better ideas (selling up) – not by offering a cheaper job.

How To Get Your Share

Some contractors will wind up with a bigger share of the market than others. You can be one of these by following these suggestions: tie in with such powerful national promotions as the "Housepower" and "Live Better ... Electrically" Campaigns.

Sell the advantages of modern electrical living at every opportunity – through friends, civic and trade associations, neighbors.

Thirdly, present these advantages to your customers in terms they can understand – not in technical jargon. They'll buy when you point out the safety, comfort and convenience of a modern electrical system.

You, the contractor, are the industry's most intimate contact with the consumer. It is to you he will turn for the professional advice he needs. You should be prepared to fill that need.

First published last year in the interests of the Electrical Industry, this message is repeated by special request. For reprints, write Dept. EW at

MURRAY MANUFACTURING CORPORATION

1250 Atlantic Avenue, Brooklyn 16, New York

Murray

Manufacturers of: Safety Switches, Service Entrance and Meter Mounting Equipment, Fuse Panels, Fully Magnetic Circuit Breakers and Load Centers.

ADEQUATE WIRING SERVES AND SAVES

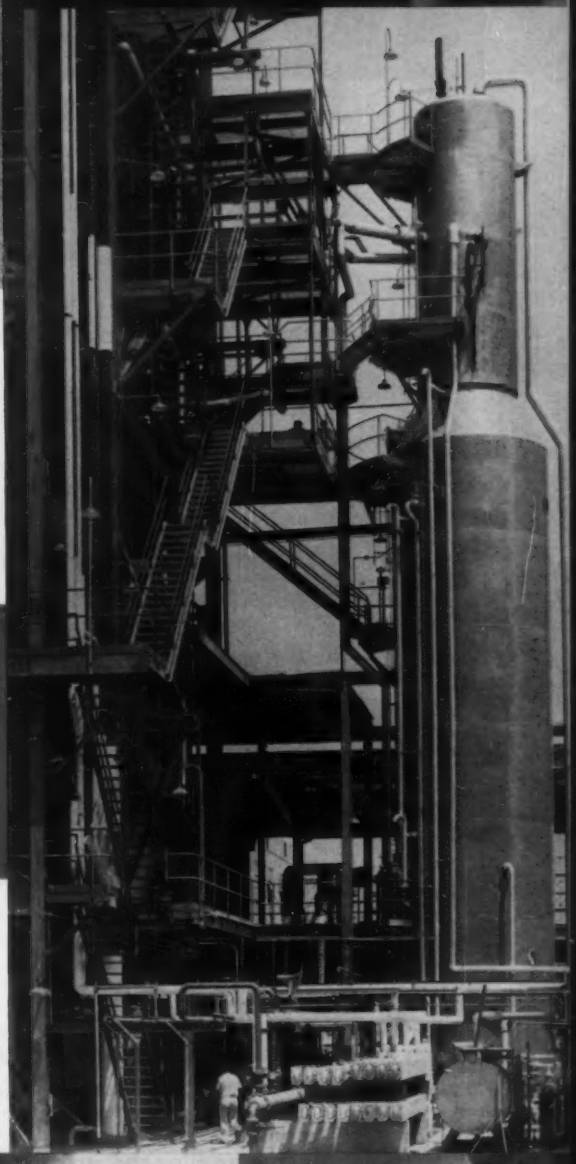
HOUSEPOWER

LIVE BETTER ELECTRICALLY

OPERATION Better Your Living HOME IMPROVEMENT

FOR A HAPPIER AMERICA AT HOME

WHEN you consider expansion...
...the most important
investment you can make is in
the creative ability of men.

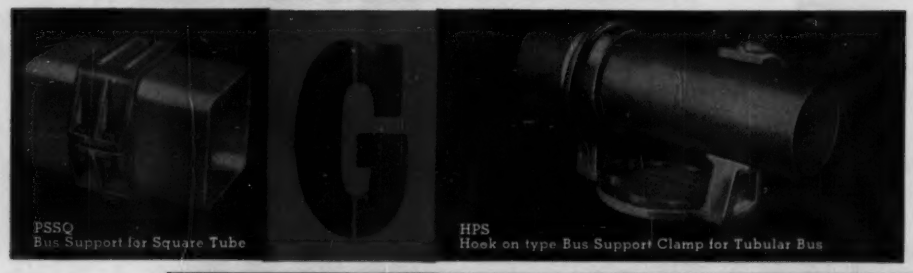


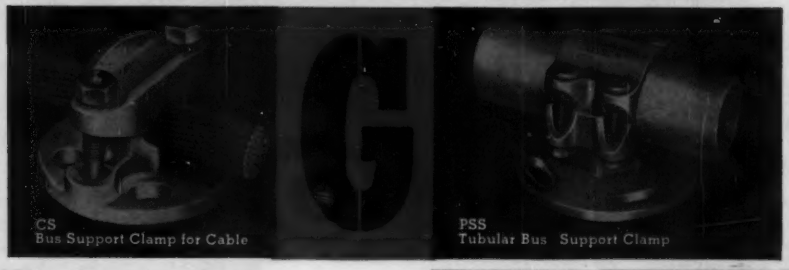
FLUOR

The Fluor Corporation, Ltd.
Engineers & Constructors
2500 S. Atlantic Blvd., Los Angeles

→

Completed 40 days ahead of schedule this new 60,000 KW steam electric unit at San Bernardino is producing profits for California Electric Power Company.





DOSSERT HIGH-STRENGTH BUS SUPPORTS

• Higher cantilever strength • Higher impact resistance
• Higher corrosion resistance • Greater durability

These Dossert Bus Supports are made of a high tensile strength cast bronze alloy and are equipped with silicon bronze bolts and nuts, making the entire unit completely non-magnetic. Available for all sizes and types of busses. Dossert Bus Supports can also be furnished in Coupling, Tee Connecting, Elbow Connecting, Tee Coupling and Expansion Connection types.

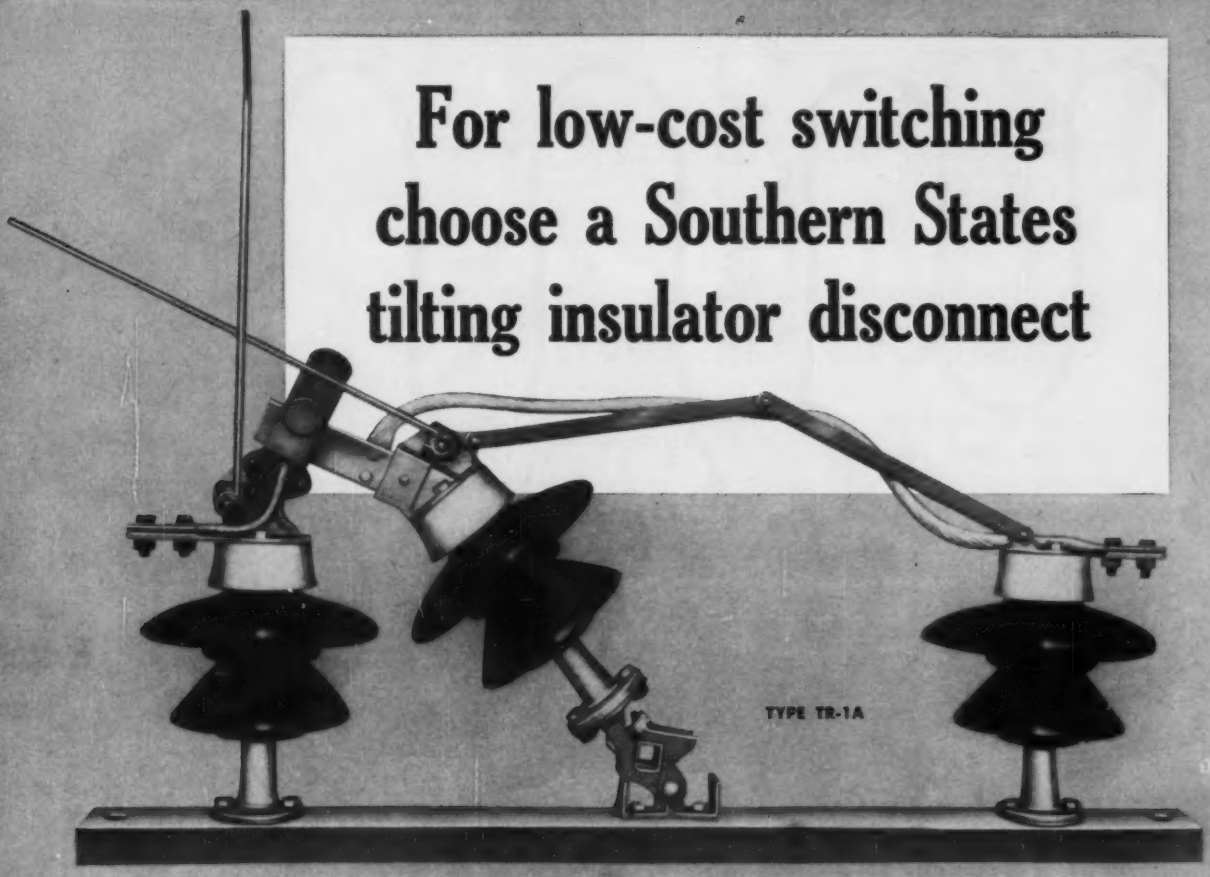
Special fittings and modifications can be readily supplied on short notice.

50 YEARS OF TECHNICAL LEADERSHIP

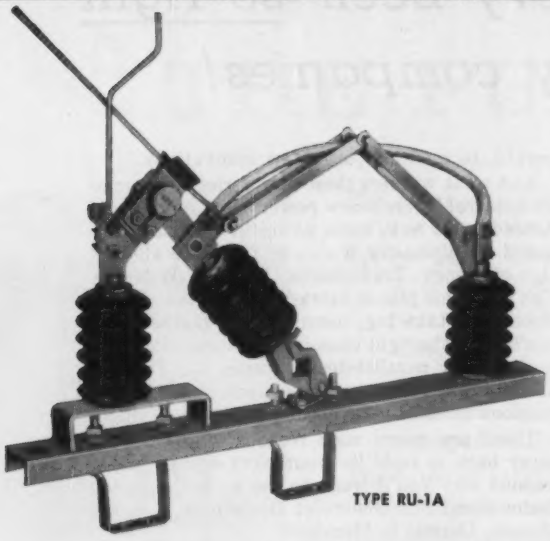
DOSSERT MFG. CORP.

249 Huron Street, Brooklyn 22, N. Y. • Representatives in all principal cities
IN CANADA: W. S. Gerrie & Assoc., Ltd., Toronto

For low-cost switching choose a Southern States tilting insulator disconnect



TYPE TR-1A



TYPE RU-1A

TWO COMPLETE LINES

When easy, low-cost installation is the first requirement for disconnecting switches, Southern States offers you not one —but two complete lines from which to choose.

The Type TR-1A is a high-quality rocker-type disconnect that meets NEMA Standards in every respect. It is available in voltage ratings from 7.5 kv through 69 kv and continuous current ratings of 200, 400, and 600 amps.

The Type RU-1A is a distribution level tilting insulator switch specifically designed for pole-top mounting. Its dielectric strength is the same as standard levels for other distribution equipment, but it is below NEMA Standards for power switching equipment. It is available in voltage ratings of 7.5 and 15 kv and continuous current ratings of 200 and 400 amps.

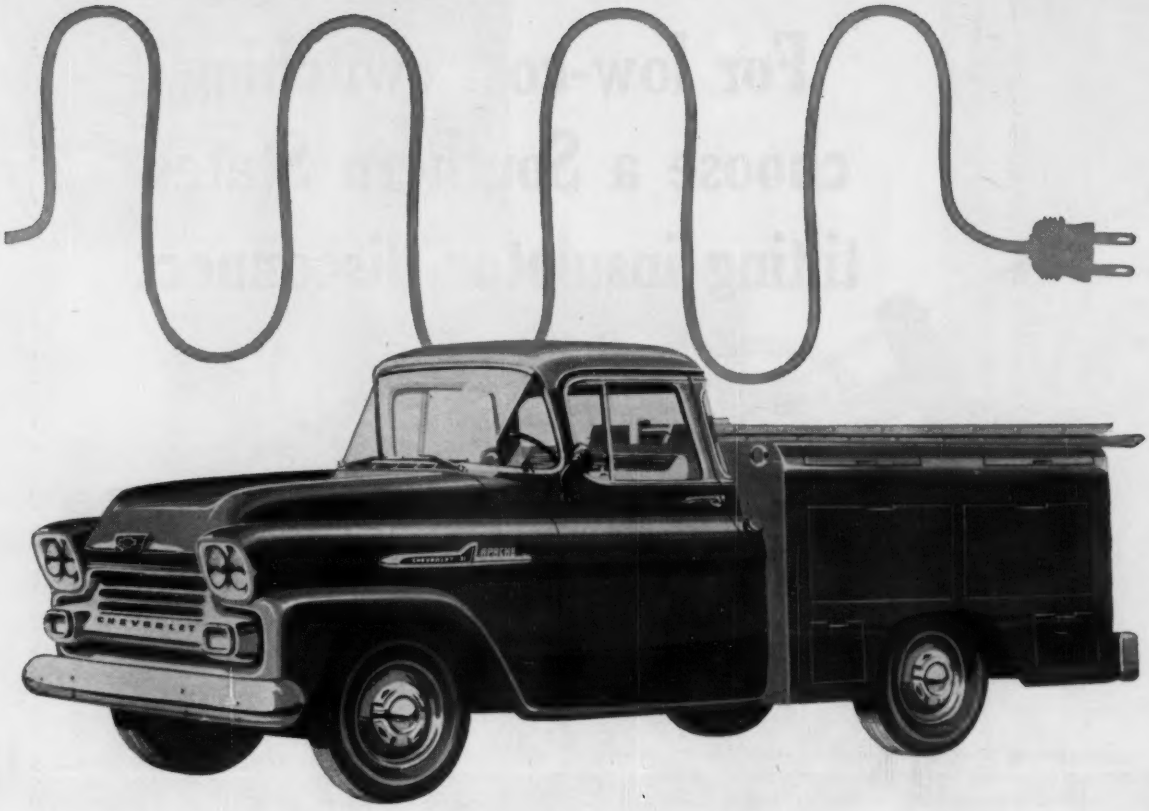
Both types are ruggedly constructed, and will provide reliable switching under all service conditions. Many utilities throughout the nation have found in these switches the answer to their needs for low-cost, easily installed disconnecting switches. So can you. Get full details in our Bulletins 54 RU and 3050.

EASY INSTALLATION

One reason utilities find the installation of these switches so easy is the method for affixing the interphase shaft to the rocking insulator. The shaft is laid in its proper position across all three phases and then only one bolt per phase is tightened to complete the installation, saving valuable installation time in the field.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto



Never before has Chevy been so right for electric utility companies!

Here's a truck specially designed to take to your kind of work like a duck takes to water! It's Chevrolet for '58 with new hustle, muscle and style that mean money in your pocket!

As you can see, Chevy's a honey of a truck this year, and that handsome, broad-shouldered '58 appearance only hints at the host of new and improved features that are ready to put you dollars ahead in the years to come. *Here's a truck ideally suited for your line of work.* In styling, for instance, Chevrolet for '58 has what it takes to build your business prestige every day in the week: new dual headlamps, new massive grille, newly contoured hood and fenders, new cab beauty, to mention just a few innovations.

And what workers these new Series 30 Apache models are! There's new power to do more work faster from a new, more powerful version of the famed Thriftmaster 6 . . . or from the all-new high-efficiency Trademaster V8. G.V.W.'s are high to let you pile on extra-heavy loads and long wheelbases take big, roomy utility bodies. And you'll have the right chassis components for your work: husky parallel-design frame, big Torque-Action brakes, and the proper springs and transmissions to meet your needs precisely.

There are many such reasons why Chevy's never been *so right* for your work—many more reasons why you'll want to see your Chevrolet dealer soon! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

CHEVROLET

NEW CHEVROLET TASK·FORCE 58 TRUCKS

Westinghouse

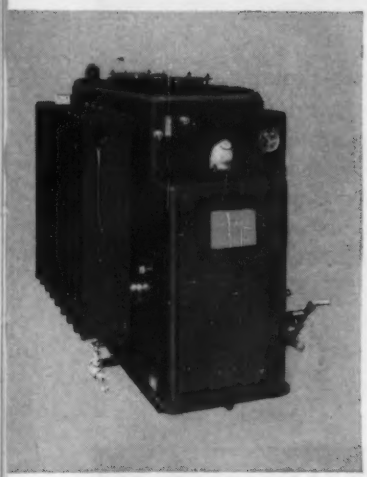
SPACE-MISER

NETWORK TRANSFORMER

This is a modern design network transformer produced to the exacting requirements of modern network systems. It provides high utilization kva together with greater reliability, reduced maintenance and simplified inspection. It affords the reserve ability necessary for emergency operating conditions. The SPACE-MISER, with its greatly reduced size, is made possible through advanced engineering, materials and manufacturing techniques developed by Westinghouse Transformer Division.

FIRST WITH THE FUTURE

THE DECAL TELLS ALMOST THE FULL STORY



The decal reproduced above is applied to every Westinghouse SPACE-MISER network transformer. It tells almost the full story . . . almost—but not quite. What it doesn't tell is that:

The new SPACE-MISER has been reduced *12 inches* in height —it can now be mounted off the floor of the vault.

The new SPACE-MISER weighs *20% less*—installation is easier, faster; handling is safer.

The new SPACE-MISER occupies *15% less* vault space—less cramped vaults mean easier maintenance.

The SPACE-MISER is another example of how Westinghouse Plowback of Earnings—into research . . . and development of better materials with more efficient utilization of existing materials—produces the improvements that set the pace in helping electric utilities keep electricity America's biggest bargain.

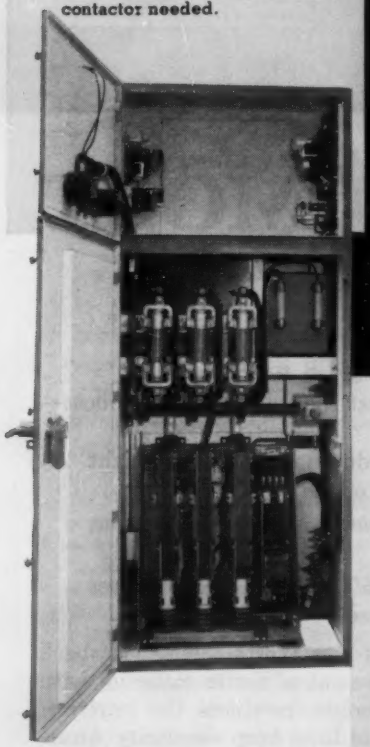
You can get the full story of what the SPACE-MISER offers for *your* network operations by calling your Westinghouse sales engineer . . . J-70854

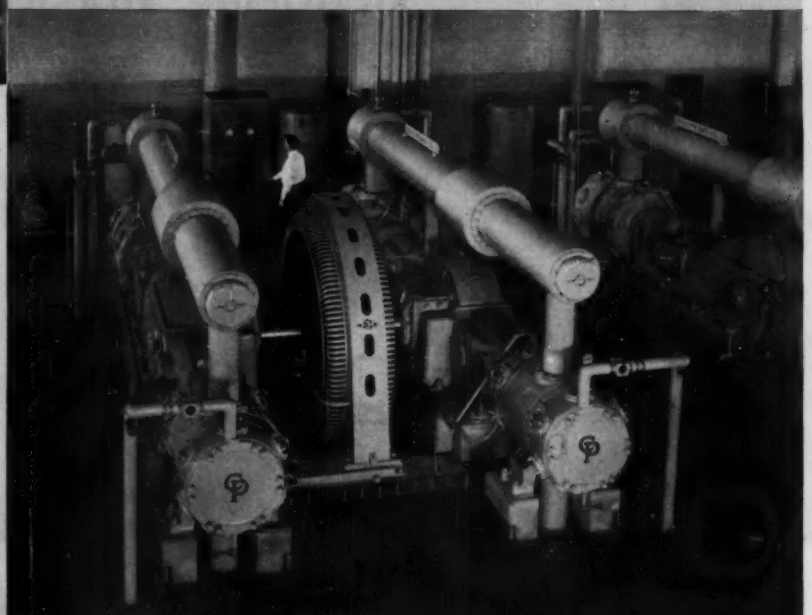
YOU CAN BE SURE...IF IT'S Westinghouse

The most complete synchronous motor protection you can buy

Above and at right • Four EC&M 1000 HP, 2300 Volt Synchronous Starters on air-compressor drives in Chrysler Corporation's new Ohio Stamping Plant at Twinsburg. Purchased and installed by Hatfield Electric Co., Cleveland, Ohio.

Below • Inside view of starter showing compact arrangement of fuses and contactor. The three arc shields slide out for quick access to both front and rear contacts—no draw-out of contactor needed.





EC&M 2200-4800 VOLT STARTERS

• A push of the "start" button gives you complete protection during starting and running—*plus* EC&M *fully automatic synchronization.* Throughout the entire sequence, motor windings are completely protected and synchronization occurs at the most favorable time. Should the motor pull out of step because of voltage dip or overload, the field is automatically removed. Re-synchronization occurs when the motor re-accelerates the load. Short circuit protection is provided by current-limiting power fuses working in conjunction with EC&M's *"certified"* high-interrupting-capacity ZHA air-break contactor.

For complete details...

WRITE FOR BULLETIN 8210

THE ELECTRIC CONTROLLER & MFG. CO.

A DIVISION OF THE SQUARE D COMPANY

CLEVELAND 28 • OHIO

B897

STRONG

...THIS WAY, TOO!

Rigid Insulating Core Contributes To High Mechanical Strength of O-B Bushings

Exceptionally strong, rigid insulating cores are one result of O-B's modern condenser bushing manufacturing methods. This source of extra strength is not wasted. Flange and ground sleeve are designed to contact this core at strategic points to exploit its stiffness. The result is a bushing as strong, or stronger than its predecessor, which for many years served so well on the highest rated oil circuit breakers.

Fifty years of priceless experience and excellent reputation stand behind today's O-B bushing. It is the product of a completely new plant.

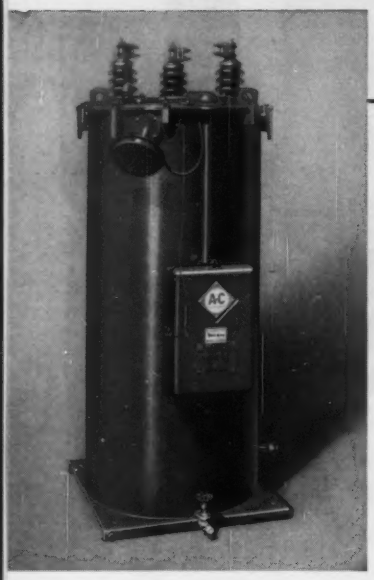
For ingenious design and downright dependability, specify O-B on your new station equipment.

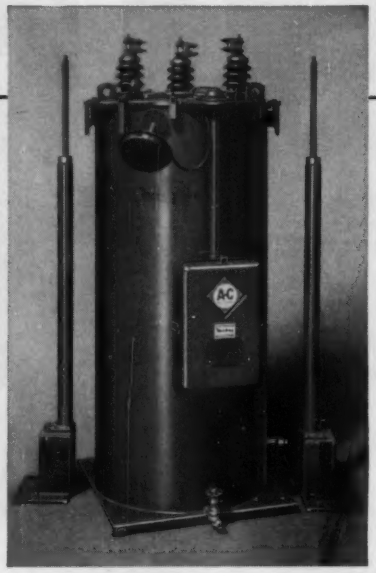
OHIO BRASS COMPANY, MANSFIELD, OHIO

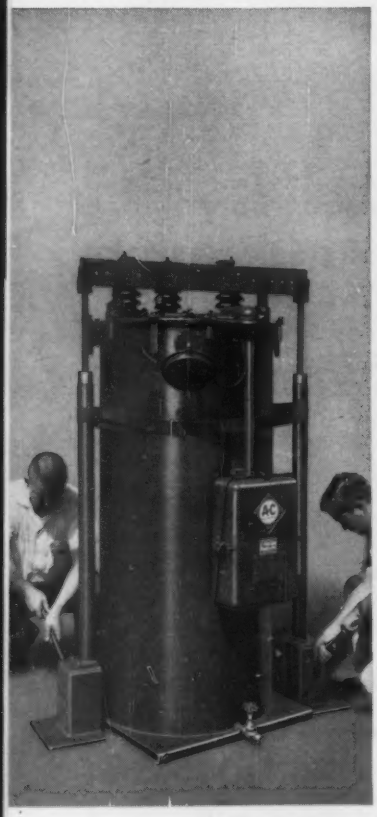
Ohio Brass

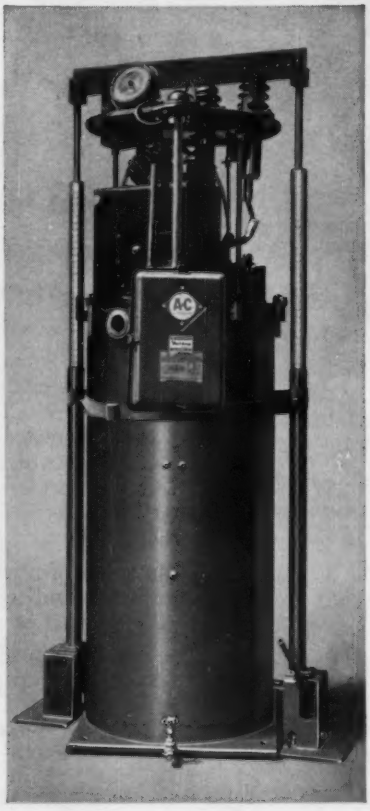
4892-H

Allis-Chalmers – Originators of 5/8% Step Regulators









Get "On-the-Site" Inspection with Unit Construction

Allis-Chalmers unit construction means the transformer and tap-changing mechanism are suspended from the cover. This assures these advantages:

Easy servicing — Piecemeal inspection is eliminated by unit construction and cover suspension. There's no need to drain oil, remove bushings or control leads, or move the regulator. Field inspection is further simplified with inspection jacks which are used, as shown in photos at left, to raise mechanism high enough to permit servicing on-the-spot.

Superior workmanship — All connections during manufacturing are made out in the open before the unit is tanked. Entire operating mechanism and control can be inspected and operated while untanked.

* * *

For details of these and other advantages of Allis-Chalmers regulators, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5587

FEBRUARY 10, 1958

King Coal Becomes King

In 1951, 50% of power generation in the United States was provided by coal. By 1957 the percentage attributed to coal had increased to 55%. And energy generated with coal had almost doubled.

This is a sample of the drama which is unfolding as electric utilities become the largest customer of the coal industry. In the next eighteen years we will see this trend increase in velocity as oil and gas become more valuable for other uses and before atomic power can claim an appreciable percentage.

Now, if the industry just doubles output every ten years, we will be producing about 2.4 trillion kilowatt-hours in utility plants in 1975. Industrial plants will probably be using a sizable amount in addition. If we assume a very likely proportion of 70% of the generation with coal burning plants, one comes up with 1.7 trillion kilowatt hours with this fuel. Compared with 0.35 trillion kilowatt-hours produced this way in 1957, we calculate an increase of almost 500%.

Assuming an increase in the efficiency of coal use of 15% in the next 18 years we arrive at an increase in use of coal of 400%. Now we have a very simple ratio for both the utility industry and the coal industry. Just plot the growth in utility output and expand the use of coal at the same rate and you have a good conservative estimate of the coal requirements in any one year you choose.

The rest of the problem may not be so simple. For there are many complicated problems to be solved all along the way. Here are a few of them:

1. When will new plants require coal burning facilities?
2. What kind of coal will be available?
3. What price should be assumed for coal, oil, and gas?
4. Where should the plant be located to reduce transportation costs to a minimum?
5. What will be the relative cost of transportation by barge, rail, pipe, and transmission line over the life of the plant?
6. For some areas, will nuclear fuel win the race with coal in competing with gas and oil?
7. What if energy sales grow faster than predictions?
8. What is to be done about air polution?

That is a sufficient sample of the complexity of the coal problem. We have omitted the multitude having to do with gas and oil supplies, hydro-electric projects, and nuclear power.

Certainly, we have amply demonstrated the importance of coal and some of the problems which are before the electrical industry. On the other side we have the coal industry which must supply these requirements. Their problems include:

1. Depletion allowances of 10% which are very low.
2. Capital costs running from $4 to $10 per ton of annual capacity put in operation.
3. Coal preparation, quality, standards, and transportation costs.
4. Fluctuation in overall demand for their product.
5. Continuing squeeze on price.

Now most of these problems growing out of "King Coal Becoming King" are industry problems, but there is much room left for joint action. We sincerely hope to learn soon, that these two important basic industries—utility and coal—have begun to solve their common problems jointly and expeditiously. For there is money to be made and saved on both sides as "King Coal Becomes King" and a good and faithful servant at the same time.

IN SAN FRANCISCO, Mayor George Christopher signs and seals a proclamation designating Feb. 9-15 as National Electrical Week. From left: John C. Beckett, San Francisco Electric Club; Philip Deovlet, Northern California Electrical Bureau; W. L. Greer, Pacific G&E

IN ST. LOUIS, Mayor R. R. Tucker (center) gets replica of Edison's first light bulb. From left: Paul Nolte, IBEW; Dudley Sanford, Union Electric; Joseph Schaeffer, Carl I. Schaeffer Electrical Co; Merrill E. Skinner, chairman of National Electrical Week

Electrical Week Gets Set for

Division managers playing big roles as responsibilities for setting up activities and publicity falls to many; some utilities promoting Housepower and LBE

Utility division managers are playing some of the key roles in this year's observance of National Electrical Week Feb. 9-15.

Montana Power Co offers a good example. Each division manager has set up a representative committee which serves as a focal point for special activities and publicity.

Governor, Mayors Participate

In Montana, the governor and mayors in most cities served by Montana Power have issued proclamations. The proclamations recognize the importance of electricity and its industry to social and economic strength, and pay tribute to electrical pioneers typified by Thomas A. Edison, whose birthdate is Feb. 11.

Issuance of the proclamations launched open houses in all divisions with free souvenirs for all. The 23 radio stations in the company's service area began carrying 60-sec spots. College and high school papers are carrying division-originated ads plugging the virtues of electrical engineering as a profession, as well as the week.

James Glover, head of youth activities, has started fulfilling 39 high-school bookings with a 30-min program keyed to NEW.

In nearby Wyoming, Cheyenne Light, Fuel & Power Co is helping a dozen local appliance dealers promote washers and dryers.

Connecticut Light & Power set up a comprehensive program shouldered by its 20 territorial managers. "Through a variety of activities, district personnel completed a program which emphasized the indispensable role of electric service to thousands of our customers," said Vice Pres A. M. Wade.

CL&P Offers Program

CL&P's public relations department and sales staff turned out a recommended program filling five pages with single-spaced typescript.

In handing out the recommendations, Wade told his managers: "It is hoped that these suggestions will stimulate thinking of local committees which will then adopt variations and improvements, eliminate others, and originate still others."

Nationally, Electrical Week is probably best characterized by the publicity it is getting:

Pacific Gas & Electric is devoting its entire February electrical ad budget to the observance and the promotion of a $20,000 contest. Contest winners will receive appliances, radios, or electric housewares. Although the contest runs from Feb. 3 to March 10, much of its promotion is tied in with the week. Entry blanks are enclosed with bills. Tie-in kits were sent to dealers, distributors, and manufacturers.

Salt River Power District created a three-pronged program:

- It dedicated a $24-million, 200-Mw Agua Fria steam plant Feb. 7, and planned an employee and family open house on the 8th, and public open house on the 9th with 5,000 visitors expected.
- It opened seven Gold Medallion homes with a promotion scheduled to begin Feb. 7. The houses apply either heat pump or radiant heating, and include such major appliances as hot-water heaters.
- It planned programs to be given at 20 local service clubs with presentations to be made by Power District personnel.

Consumers Power is capitalizing upon special newspaper sections with two ads scheduled to run in 22 daily papers and 116 weeklies. One ad is institutional, honoring Edison. The other deals with Housepower and a $100,000 consumer contest. They will be supported frequently by tie-in

THE LADY IN THE HOUSEPOWER DRESS is Miss Patti Prichard, a television personality, who is drawing the winner's name in a $20,000 Northern California Electrical Bureau appliance contest. She is backed up here by members of the judging committee

THIS IS BART JONES, sales representative for Sacramento Municipal Utility District. He's discussing with Mrs. Philip Pearl the Housepower rating of her home. SMUD is using National Electrical Week to open its second annual free wiring survey

Third Go-'Round—Best Yet

ads inserted by dealers, adequate wiring bureaus, electric clubs, or contractors' associations.

Company also invited the high school Junior Engineering Technical Society to visit Fermi Atomic Power Plant, being built at Monroe, Mich., on one day of the week.

In Detroit, the Electrical Inspectors group plans its fifth observance —for the idea started six years ago with the Michigan Chapter of the International Assn of Electrical Inspectors as a state-wide celebration, reports Detroit Edison Co.

Appliance dealers will celebrate with special displays and prices. Contractors will give free Housepower ratings. Two special TV shows were planned for Feb. 9. On one program H. B. Love, chief electrical inspector, and his department dramatized their work for the City of Detroit. The other was a remote telecast from Edison's laboratory at Greenfield Village.

So Cal Ed Barrages Papers

Southern California Edison plans a publicity barrage at district and metropolitan newspapers. Some of the stories will deal with Science Youth Day and the industry's interest in encouraging students to major in engineering or science and seek utility jobs.

Edison is cooperating also with the Electric League, the Los Angeles Dept of Water & Power, and the Pacific Telephone & Telegraph Co in planning coordinated publicity. Los Angeles Dept of W&P is sponsoring a Queen of Electric Week. A special song was composed for the queen, TV starlet Patti Harrison, to sing at banquets and meetings.

SMUD Pushes Rewiring

Sacramento Municipal Utility District and Sacramento Valley Electric League are using the week to spearhead an intensive home rewiring drive. Housepower is to be hit hard in advertisements. Free wiring surveys are being offered the public. Representatives carry Amprobe Jr, a pocket-sized volt-ammeter which succeeds dramatically in presenting to homeowners a picture of overloaded circuits. Last year's campaign led to 251 jobs totaling $65,987 done by 32 contractors.

Back-up coverage on a national level will be given by an "umbrella" of radio, TV, and publication advertising. NEW Committee Chairman Merrill E. Skinner of Union Electric Co said this year will beat last year in terms of activity-level and impact.

Some advertisers with sizeable audiences include:

- Westinghouse Electric Corp. Tonight's "Studio One" commercials are to feature the observance. The message also is to appear in Time, Home Furnishings Daily, and a week-long series of radio-TV programs in major cities in which the company operates.
- General Electric Co. Sunday's "General Electric Theater" TV show and Arthur Godfrey's network radio program of today stressed the National Electrical Week theme. Living for Young Homemakers carries a special ad.
- Allis-Chalmers Mfg Co. A four-color ad spread in Saturday Evening Post is a major A-C contribution to the observance. The company's National Farm & Home Hour plugged the theme last week. Regional and local radio programs will follow suit.
- Live Better Electrically, Electric Companies Advertising Program, Reddy Kilowatt Inc, Waring Products, Frigidaire, Whirlpool, and Reynolds Metals Co are a sprinkling of other groups with national plugs.

Among activities outside the U. S., Hawaii will be the scene of more intense participation this year than last. Utilities, dealers, and Honolulu's two main dailies are cooperating with Pacific Coast Electrical Assn.

One feature will be a "try a fixture free" offer. Lighting people say the aim is to encourage customers to take fixtures home for a no-obligation trial. A special promotion of Housepower is under way and institutional ads and editorial copy will herald Edison's birthdate.

The News-Beat

Cut and Cover

The Federal Power Commission has cleared the way for construction of the Niagara Falls power project. It ruled last week that the New York State Power Authority must construct a "cut and cover" conduit over the entire four-mile length of the waterway between the intake works and Tuscarora forebay. A cut-and-cover conduit is built by surface excavation of a deep cut in which a concrete conduit is built. The excavation is then filled, and the conduit covered.

In New York, the Authority said construction is scheduled to start about April 1, with the 1,800-Mw project delivering its first power in three years. But the cut-and-cover conduit will cost $25.7 million more than the Authority's original canal plan, increasing cost per kwhr from 0.09 to 0.12 mill.

Upon receiving the FPC ruling, the Authority promptly mailed five letters of contract awards, including two joint ventures. They were:

- To Baldwin-Lima Hamilton Corp and Newport News (Va.) Shipbuilding & Drydock Co for 13 turbines for Lewiston power plant—$20.7 million.
- To Westinghouse Electric Corp for thirteen 13.8-kv, 167-kva generators—$20.1 million.
- To Allis-Chalmers Mfg Co for twelve 13.8-kv-generators, 37,500-hp-motor units for the Tuscarora pump-generating plant—$7.1 million.
- To Allis-Chalmers Mfg Co and S. Morgan Smith for 12 pump-oblique turbines for Tuscarora—$11.3 million.
- Ferranti Electric, Inc., for 13 power transformers for Lewiston—$3.9 million.

The Authority also announced that it had obtained a $100-million short-term loan for initial financing of the $625-million project. Money was obtained from 17 banks in New York City and the state for one year at 2% in bond anticipation notes.

Atomic Joust

The Joint Committee on Atomic Energy is warming up to its annual joust with the Atomic Energy Commission over AEC's progress in harnessing nuclear power to peaceful purposes.

This year the kickoff is by the research and development subcommittee, which last week opened an intensive investigation into the status of basic research. Fifty of the nation's top scientists are testifying on subjects ranging from nuclear chemistry to the controlled-thermonuclear research program.

Dr Glenn T. Seaborg, University of California, and Dr Frederick Seitz, University of Illinois, called for a 50 to 100% increase in spending for basic research. They added that the AEC, which spends $70-million a year in this field, should chip in heavily.

For the power industry, the climax will come when the full joint committee looks into the growth and state of the atomic energy industry in the last two weeks of February. The committee is expected to seize this opportunity to press AEC for a more vigorous government power reactor development program.

Strategic Maneuver

A final death blow to a federal Hells Canyon project was averted last week by a strategic maneuver of the House Interior Committee. Now the Senate-passed measure won't be considered until June 2.

Opponents were anxious for a quick vote and thought they had enough strength to kill the bill. But Chairman Clair Engle (D-Calif.) foresaw a prolonged fight that would tie up the committee and stall more pressing legislation. Work on two private dams being built by Idaho Power Co has gone ahead so far that if Hells Canyon isn't authorized this session, it is felt no serious effort can be made in future congresses for approval of the federal proposal.

Vote Coming on Trinity

Hearings on the Administration's partnership proposal for Pacific Gas & Electric to buy and develop falling water from the Trinity project were completed last week and a vote is imminent.

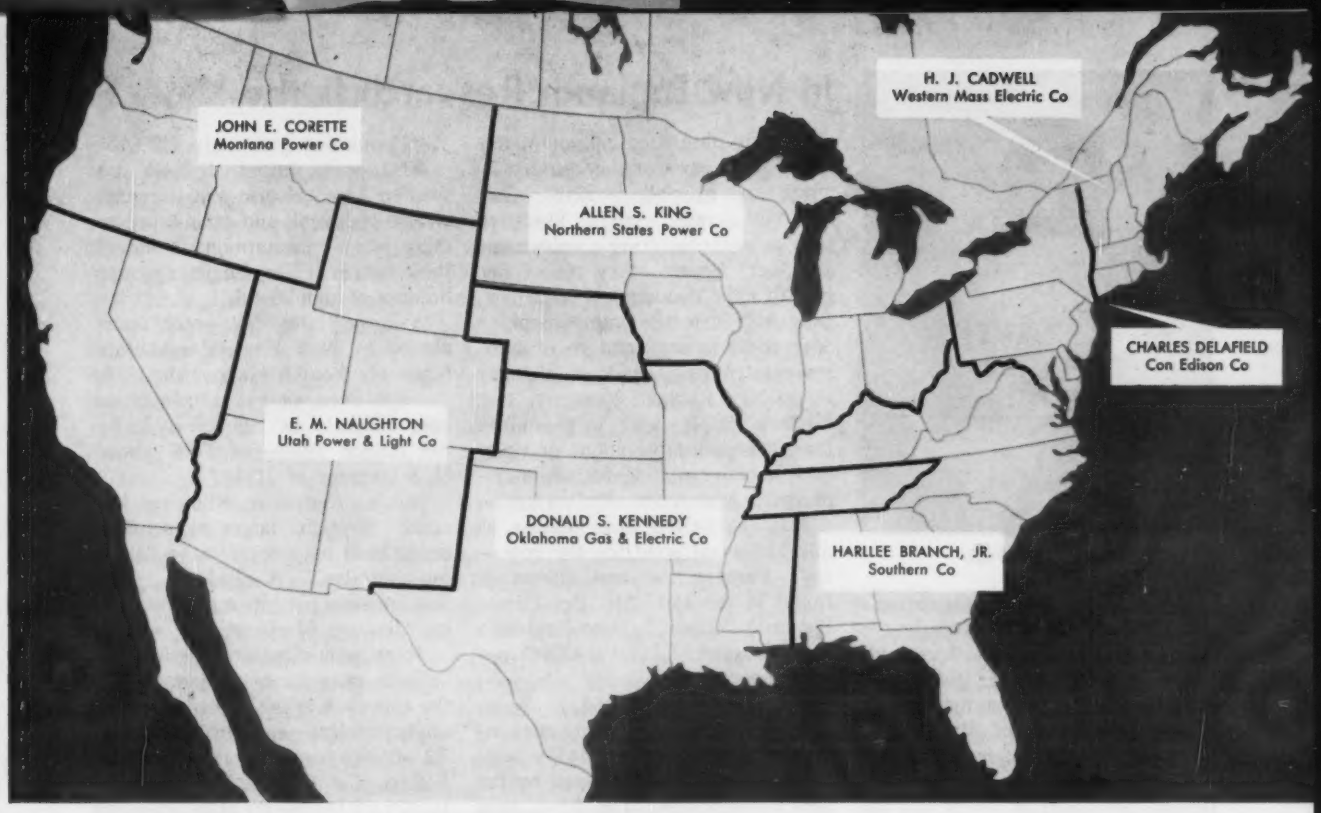
Interior Sec'y Fred A. Seaton spent a full day supporting his recommendation that private development is the "best arrangement for the good of the people served by Central Valley Authority."

Seaton brought to the committee revised estimates of increased Trinity costs, which now he says will cost $262 million instead of last year's $225-million figure. Power facilities, which PG&E would finance, have risen from $55.5 million to $60 million. The revisions also showed a substantial increase in power costs to preference customers. Despite his higher estimates, Seaton stood firm for the partnership proposal that would call for PG&E paying $46.6 million a year for 50 years for the falling water.

Chairman Clair Engle (D-Calif.) charged Seaton with reversing the direction of Reclamation policy of 50 years by "reversing the low-cost power principle for preference customers."

Seaton said he was not trying to initiate a "wholly new concept of Reclamation law." He contended that "this is not low-cost power that will be developed at Trinity." He said it would cost around 8.9 mills, and by selling it to PG&E at around 10 mills the government will make out better than if it marketed the power itself at CVA's prevailing 4.5-mill rate.

Outlook for approval of the bill is touch-and-go. Engle can muster all but two Democrats against it, but it is questionable whether he can pick up any Republican votes. However, should the bill pass the House, it would run into bipartisan opposition in the Senate Interior Committee.



Utility executives give regional reports and . . .

Panel on Power Progress Foresees Era of Growth for U.S. Economy

A spirit of unabashed optimism pervades the electric utility industry despite the drag of the current recession. This is the view of six utility company officers who last fortnight provided a round-up of their respective regions. They took a look at future power expectations and a general view of their area economy.

"We can't worry about the next six months when we have to order generating units three or more years in advance," said E. M. Naughton, president of Utah Power & Light Co. Population growth predictions, the upturn in defense spending and a replenishing of manufacturers' inventories were a few of the reasons for the optimism for 1958. Significantly, the speakers reported no cutbacks in construction spending were contemplated by power companies they had surveyed.

In a question-and-answer period, the speakers were asked for specific growth-factor examples.

In reply, John E. Corette of Montana Power Co pointed to the estimated pick-up in housing starts, which is expected to plug the gap for the lumber industry. The low ebb of copper production is due to reverse itself, he said. Allen S. King, Northern States Power Co, cited a larger defense budget and increasing population as big factors assuring growth for the upper Midwest.

One tough question was: Will gross incomes keep pace with increased capital expenditures?

Said Harllee Branch, Southern Co: "We anticipate no dilution in net income. If it does go down, we're not going to sit around; we're going in for rate increases." He added that no applications for increases are expected in the immediate future.

Howard J. Cadwell, Western Massachusetts Electric Co, noted "There's a diminishing return on the savings you can make" by power pool and interconnection agreements. Corette observed that public agencies, particularly those with small operating units, are feeling inflation pressures and may need rate increases soon.

Also on the panel was Charles B. Delafield, vice-president, finance and community relations, Consolidated Edison Co of New York, Inc. He described the company's plans for spending some $800 million for new facilities in the next five years for which Con Edison will sell almost $500 million in new securities.

Since two major California utilities were in the midst of financing programs, reports were not made on this area.

The panel was held in New York under auspices of Electric Companies Public Information Program.

In New England: Research Is the Key

H. J. CADWELL

With one-sixteenth of the nation's population, New England boasts nearly one-sixth of the country's research facilities. Our great technical schools act as a magnet for growth industries of the future. The great promise of research-born industries exerts an important influence on power planning for the future.

The six-state area cannot match some other parts of the country in terms of over-all growth. Our economy is more mature. Statistics such as manufacturing employment are "net" figures—they reflect net growth after deducting a large ten-year drop in textile employment.

Over-all figures tend to obscure some interesting, dynamic changes in the New England economy. For instance employment in manufacture of non-durable goods dropped 10.6% between 1947-56, while employment in durables climbed 9.6%.

Has the switch from textiles to durables been good for the economy? Perhaps the best answer is found in the 1947-56 "Per Capita Personal Income." New England's has increased 53.1% vs. 47.4% national increase.

In the 1946-56 period, U. S. investor-owned electric companies increased generation by 154%, compared with a 95% increase by the area's companies. The 95% gain is significant in view of two factors:

- Population grew only 7.2%.
- National output figures are swollen by electro-metallurgical, electro-chemical, and atomic processing plant consumption. None of these figures in New England growth because of high-cost fuel.

Average rates for power purchased by New England manufacturers are 9 to 16% above the U. S. average even though our average cost of fuels in 1956 was 39.6¢ per million Btu's—or 56% above U. S. average of 25.4¢.

Much progress in efficiency has come through larger generating units, built on a cooperative "sharing-contracts." A grid of transmission lines permits inter-company coordination of operations.

Joint atomic research provides a striking example of cooperation in the approach to the region's greatest single problem—fuel costs. In 1954, 12 utilities formed Yankee Atomic Electric Co. Design and construction of a 134,000-kw plant are going forward under a three-party contract.

In Southeast: No Economy Lag Seen

HARLLEE BRANCH

Dynamic growth of industry since World War II is one of the remarkable economic events of our time. Whereas this region once was primarily a textile manufacturing area, now it manufactures chemicals, pulp and paper, electrical machinery, automobiles and tires, aircraft, building materials, etc.

No significant diminutation in the volume and diversity of Southeastern industrial output is expected in 1958. The economic outlook generally is optimistic.

The South Atlantic region will obtain $688,400,000 in new chemical plants alone during 1957-59, says Manufacturing Chemists' Assn.

Since 1939 more than 25,000 new industrial plants have been built in this region. Industrial output has increased in that time from $11 billion to $65 billion annually. Since World War II, the South has constructed an average of one multi-million dollar plant each day.

The electric industry is expanding more rapidly in the Southeast than in the nation as a whole. New generating capacity to be added in 1958 by the area's investor-owned companies, for example, will exceed 4-million kw. Total construction expenditures for new facilities by members of the Southeastern Electric Exchange are expected to rise from $606 million in 1967 to $696 million in 1968, and to continue at a level well over $600 million a year for the succeeding two years.

Extensive water-power development by private industry includes Alabama Power Co.'s Coosa and Warrior River projects. A series of dams will have a 633,500-kw capacity when completed. Duke Power, Georgia Power, and Appalachian Electric Power are other companies with hydro-electric developments under construction.

Looking to the use of nuclear fission as a heat source, Carolinas Virginia Nuclear Power Associates plans a 200,000-kw plant, with completion scheduled for 1962. A 50,000-kw plant is planned by the East-Central Nuclear Group, which is made up of Florida utility companies. The Southern Co. Southern Services, Inc. and its operating companies are participating in construction of the Enrico Fermi plant. Southwest Atomic Energy Associates is undertaking a multi-million dollar experimental program over the next four years.

In Upper-Midwest: Two Spurs to Growth

Two new factors have been dominant on the economic scene in the Midwest in the last few years:

- Blossoming growth of the Ohio River Valley, with location of chemical and aluminum plants.
- The St. Lawrence Seaway.

One American Gas & Electric Co executive hailed the first trend as "perhaps the beginning of the second industrial revolution."

Towns of the Great Lakes are reacting to the Seaway with civic enthusiasm, bustling waterfront expansion, and expectations for large plant expansions.

Some portions of the upper Midwest area have reacted rather strongly to the current economic readjustment, while the impact has been much less in other sections.. To determine expected developments I contacted every area power firm.

Anticipated output for 1958 is 146.6-billion kwhr, an increase of 7.7% over 1957. Gross revenues for '58 are expected to reach $2,424.5-million, an increase of 6.8%.

The companies plan to spend $1,074.3-million in new construction in 1958. Additional generating capability of 3,518,650 kw will be added during the year, bringing the companies' total capability up to 32,128,877 kw, or a rise of 11.9%.

A large majority of the companies are in some form of research and development work in atomic energy. Three full-scale atomic plants under contract involve participation of about 24 area firms.

Enrico Fermi Plant involves construction by Power Reactor Development Co of a fast breeder reactor of 100,000-kw capacity. Detroit Edison Co will buy steam and furnish generating equipment. Two groups of companies are taking part: Atomic Power Development Associates is supplying certain research and development funds; Power Reactor Development Co is financing construction.

The 180,000-kw Dresden plant on the Commonwealth Edison Co system is supported by Nuclear Power Group. General Electric Co is handling construction of the BWR plant for $45-million.

A. S. KING

Eleven utilities are taking part in Central Utilities Atomic Power Associates. They will bear a part of the costs for a five-year period to build a 66,000-kw, controlled-circulation BWR Pathfinder plant on Northern States Power Co's system.

In the Rockies: No Slack in Fast Pace

The Rocky Mountain region includes about 17% of the land area of the U. S., yet contains less than 3% of the country's population. It is one of the fastest growing areas in population, industrial development.

Combined plant account of 15 of the area's business-managed utilities serving 80% of the population—was $250 million in 1947. This figure has grown to $925 million, or to 3¾ times—not just twice as is sometimes used as a formula for utility growth. Construction expenditures in 1957 were about $113 million and $123 million is projected for 1958—a 9% increase. So, what ever the cut-backs may be in other industries and areas, there is no slackening of the pace here.

Projected construction expenditures run $120 million a year for the next five years. On the average we expect to add about 275,000 kw capacity each year.

Almost every known raw material and chemical exists in the area. Oil refineries are springing up and oil and gas pipe lines are fanning out in every direction. The area has the greatest sources of thermal energy to be found in the world.

The region is a natural supply point for the Northwest and Pacific Coast areas. The availability of raw materials leads to industrial growth right in our own territory. It ties in naturally with our space resources and our need, nationally, to disperse industrial plant.

The increase in total electric energy sales provides an index of this growth—240% increase in ten years as compared to 160% for total U. S.

Defense installations and industrial expansion have helped to bring a rate of population growth about twice that for the U. S. This rate should continue at least until 1975.

We need more water in the future and that brings us to the Colorado River Storage Project to cost $750-million. This project is needed to develop more water and as such just couldn't be built by investor-owned utilities.

E. M. NAUGHTON

In the meantime we will build steam plants and take care of our present and future customers' load requirements. Transmission lines to load centers will provide the vehicle through which all our companies will be further interconnected. We are unalterably opposed, of course, to a federal network of transmission lines in our area.

In Northwest: $1-Million a Day to '68

A majority of Pacific Northwest business leaders believe 1958 business will exceed levels established late in 1957. The general consensus is that the first half will be about the same as the last few months of 1957, but an upturn may be expected by mid-year so that the second half of 1958 will be better than the second half of 1957.

Like other sections of the nation, the area is currently experiencing business readjustments although it has had some offsetting factors that help buoy the economy.

Agriculture and livestock were good in 1957, with firm prices and good crop yields. The region will benefit from anticipated stability of this industry. A pick-up in lumbering is expected, following the anticipated increase in housing starts.

Prospects for aluminum appear to be somewhat improved. However, the non-ferrous mining industry, while it appears to have touched bottom and is destined for an upturn, may find the comeback slower.

Today there are approximately 5.7-million people in the region. The 1960 estimate is for nearly 6.25 million.

In the past ten years, investor-owned utilities of the region have added 1-million kw so that today they have 2.5-million kw of capacity. Their projects now under construction will add more than 1-million kw this year alone. A total of 1,754,000 kw of new capacity will be installed in 1958-59-60.

From 1947-57, more than $2 billion was spent by all groups—federal and non-federal—on hydro capacity and transmission. Today these groups agree it will require nearly $3½ billion to keep pace with demand in the next ten years. Between now and 1967, non-federal suppliers are expected to spend $2 billion more and the federal government, $1,444 million. The outlook is that we will have to invest $1 million a day for the next ten years to stay abreast of the growth in electric power demand.

J. E. CORETTE

Investor-owned utilities of the region will not cut back seriously in their construction programs. The high level experienced in the last several years will continue.

Nine major utilities report that $219,380,000 will be invested in new plant and property in 1958, which is close to $227,800,000 spent in '57.

In the Southwest: Industrial Front Gains

The well diversified growth of the Southwest includes these industrial fronts which saw gains in 1957, and areas planning expansions according to Donald S. Kennedy, president of Oklahoma Gas & Electric Co:

- Salaries of manufacturing are up 500% since the end of the war.
- Average of 50 new plants built a month.
- In 1947, the region was spending $450 million a year; now it is near $1 billion.
- The Southwest is important in aircraft and missile production. One-fourth of U. S. primary aluminum capacity is in the area.

To illustrate this growth, here is where investor-owned companies of the region stand and what their plans are for the future:

Oklahoma Gas & Electric Co revenues for the coming year are forecast at $55 million, an increase of 10% over 1957. A 755,000-kw peak demand is expected this year, an increase of 15%. Construction expenditures in 1957 amounted to $27 million. We expect to increase that to $35 million in 1958.

Middle South Utilities has budgeted $67 million for expansion, which is at least equal to the record amount in 1957. A large part of this money will be used for two new generators, which will raise system capacity to 2,721,000 kw in 1959.

Gulf States Utilities Co will spend $34 million on a new Scott, La., station. This plant and additions in Beaumont, Texas, will increase capacity by 444,000 kw, a jump of 50% in two years. Total output by 1959 will exceed 1.5-million kw.

Houston Lighting & Power Co spent $60 million on facilities in 1957. Expenditures in 1958 will total $67 million.

Arkansas Power & Light Co invested $13 million in expansion in 1957 to meet increased demand.

The Texas Atomic Research Foundation is sponsoring a four-year, $10 million research program to study controlled fusion as a source of useful power.

D. S. KENNEDY

Southwest Atomic Energy Associates has signed a contract with Atomics International, a division of North American Aviation, for more than $5 million in research.

We of the power industry in the Southwest feel the times call for growth. To think in terms of leveling off is to retreat when the battle calls for a strong offense.

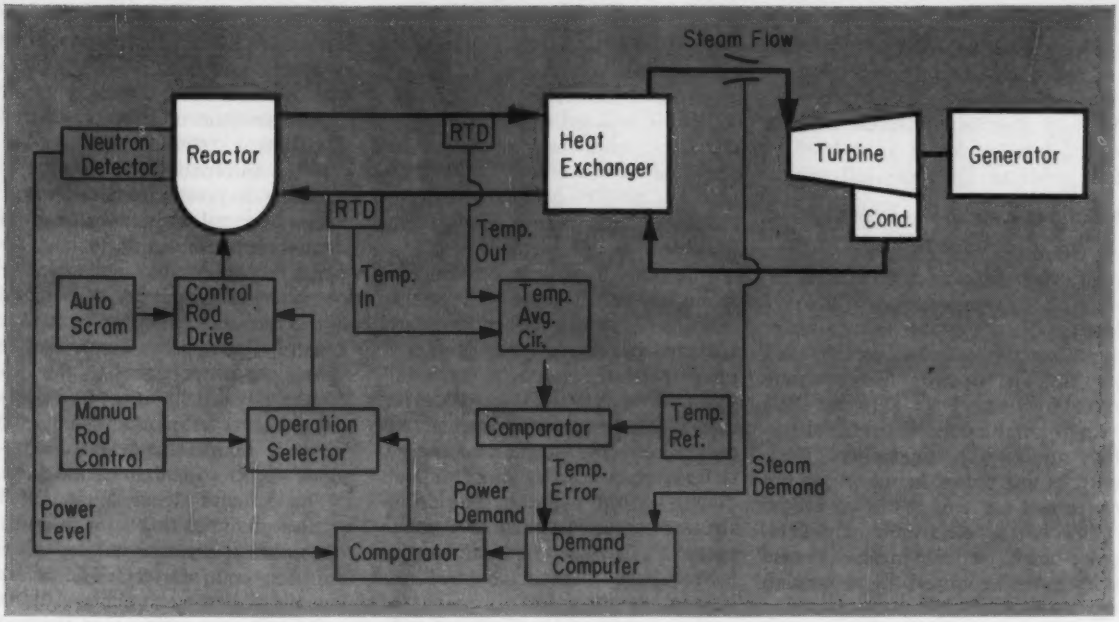


FIG 1—BLOCK DIAGRAM shows a typical type of external control system for a pressurized-water type of reactor in a nuclear-power plant. Reactor control rods, aided by negative temperature coefficient, regulate the power output

ABC's of A-Plant Electrical Design

Thermal-station engineers face unfamiliar problems in planning nuclear control systems and electrical equipment

ROBERT E. FRICK, Electrical Engineer, Nuclear Energy Division, Gilbert Associates Inc, Reading, Pa.

Most electrical engineers concerned with the design and operation of generating capacity in this country have not participated, at the present stage of atomic power plant development, in the engineering of a nuclear plant. Yet designers of conventional thermal generating plants are familiar with many problems and much equipment of a nuclear plant. Eventually, they will acquaint themselves with control systems and electrical components peculiar to power plants using atomic fuel. These systems and equipment are placed here in the perspective of the overall electrical engineering that goes into a nuclear power plant.

The electronic engineer, the instrumentation engineer, and the control engineer have an even larger area of responsibility in the nuclear plant than in the conventional thermal one. The reactor control system, responding to an electronic count of the neutron leakage from the reactor and to the demands of the external transmission system to provide a feedback signal for controlling the reactor reactivity, replaces combustion control.

The multiplicity of safety circuits and radiation monitoring channels adds to the plant electrical systems. Throughout the plant's processes, maximum advantage is taken of remote electrical control. The station service electrical system must be designed for reliability and for emergency power needs for safe shutdown of the reactor.

These new concepts of instrumentation, control, and auxiliary power systems must be integrated with the conventional electrical systems with which the engineer is familiar, and herein lies his enlarged task.

In such a plant, the reactor, with or without intermediate heat exchangers, replaces the steam generator. Its instrumentation and its heat removal and auxiliary systems include conventional temperature, pressure, level, flow, and pH measuring and controlling devices.

But the reactor, itself, introduces a new field of instrumentation and control. An operator must have continuous indication of the neutron flux and rate of change of that flux. As the neutron flux, which is the number of neutrons per sq cm per sec, is virtually proportional to the reactor's power level, it is a primary controlling parameter.

Control of the rate of change in neutron flux keeps the rate of change in power level within the rate of response of the instrumentation and control systems. Rate of change in neutron flux is referred to in terms of period, the time required to increase the neutron flux by a factor of e, (2.718).

Neutron detectors around the

reactor give signals proportional to the neutron flux leakage from the reactor core. This leakage is also proportional to the reactor power. Neutron flux is measured from a source level of about 1×10^{-10} of full power to 1.5 times full power.

Need Wide Range

As neutron detection instruments operate over a 3 to 5 decade range, multiple instrumentation with overlapping ranges obtains coverage from startup source level to full power. The neutron flux counters most frequently used are the BF_3 proportional counters, fission chambers, and ionization chambers. Their outputs are pulses in the μv or mv range and currents in the μa range.

Specialized electronic amplifiers, pulse-height discriminators, pulse shapers, and counters for processing signals from the neutron-detecting instruments give rapid and accurate intelligence of the reactor's behavior. This information is conveyed to conventional indicating instruments and recorders in the main control room.

Output signals from these instrumentation channels are used also for alarm purposes, automatic safety actions, and automatic control when operation is at a power level producing electrical energy. An operator must know the neutron level and period for intelligent control of the power output. The reactor's reactivity is a measure of whether the neutron flux, hence the power level, will increase, decrease, or remain constant.

Reactor reactivity is determined from the balance between neutron production and the sum of neutron leakage and neutron absorption. By altering any of these three parameters, the reactivity, and hence the power level, can be controlled. In most heterogeneous reactors, reactivity is changed by withdrawal or insertion of neutron-absorbing materials in or around the reactor core. In a pressurized-water type design, neutron-absorbing rods are inserted among the fuel elements in the reactor core.

When the reactivity is increased sufficiently to cause the neutron flux to increase continuously, the reactor is supercritical and the power level increases. When the reactivity is decreased so that the power level is decreasing, the reactor is subcritical. At zero rate of change in neutron flux, ie, an infinite period, the reactor operates at a constant power level and is critical.

Fuel is injected into the combustion areas of a conventional power plant only as required by the instantaneous power demand. But in today's atomic plant, enough fuel for several years' operation is placed at one time in the reactor. Nuclear reactions can release the energy from this fuel at a tremendous rate. Control circuits, designed for maximum speed of response and reliability, must at all times regulate the rate at which potential nuclear energy is converted to thermal energy.

Reactor control is most difficult during startup, as the measuring instruments are least reliable at lower power levels. The common practice is to have manual control for startup, the operator observing the period meter and the flux-level indicator and manually increasing reactivity at a given rate. Thus he makes the reactor supercritical until a specified period indication is obtained. The reactivity is then adjusted to maintain this period until the desired power level is reached.

Reactivity is then decreased so that the reactor falls from the supercritical state, a condition of increasing power, to exact criticality. Criticality is the condition of zero rate of change in neutron flux, infinite reactor period, and constant power level.

The reactor control system usually is transferred from manual to automatic operation after a specified minimum power level, such as 10% full power, is reached. The automatic control system must respond to both an electronic count of the neutron leakage from the reactor and the demands of the external electrical transmission system.

Requires Specific Design

In the present state of nuclear plant development, the control system must be designed specifically for each reactor. For each reactor design, transient studies on an analog computer must optimize the system and component designs so that they satisfy response and stability criteria.

Besides the controlled changes in reactivity, transient or sustained reactivity changes are produced by other phenomena in the reactor operation. Reactor temperature and pressure, depletion of fuel, and the presence of fission-product, neutron-absorbing poisons affect it. As these four parameters are functions of time, their effect must be considered in a control system.

In the automatic-control mode of operating a pressurized-water type reactor, control rods, assisted by a negative temperature coefficient, respond automatically to raise or lower power output as determined by the throttle demand. The power demand signal may consist of a component proportional to the difference between the measured average coolant temperature and the reference temperature, and a component proportional to steam flow.

The demand signal is compared with the neutron-flux measurement to obtain an error signal for actuating the control rods. The steam flow signal is used to achieve direct and rapid measurement of thermal power demand, so as to obtain good transient response for rapid throttle changes. The integral of the average temperature error could be used to supplement the steam flow signal, where the latter might be in error.

Safety System Comprehensive

Overall safety systems protect the plant, equipment, personnel, and environment against accidents. They prevent dangerous operating conditions arising from equipment malfunction or failure, improper assembly, or mistakes in operation. The reactor becomes a health hazard only if an excessive amount of radioactive materials is released accidentally from the shielded areas of the plant. This is the prime factor in determining the emphasis on the prevention of equipment rupture and effecting rapid shutdown upon system malfunction. It is important to have control at all times of the nuclear and thermal energy systems, so that these systems do not exceed design limits.

Besides normal control circuitry, overriding safety circuits must be provided. These keep reactor operation within safe limits. The overall safety system prevents mistakes in operation by the use of interlocks; through automatic action, it should correct the error or notify the operator of a potentially hazardous condition; and, again through automatic action, it shuts down the reactor as swiftly as possible when instruments

show the approach of a dangerous situation. Such high-speed shutdown is called a scram. Reactor operating conditions involving the greatest hazard are excessively high neutron flux, excessively short period, and inadequate coolant flow.

A level-limit safety circuit prevents either the operator or the control system from increasing neutron flux beyond 100% full power. Because of the rapid rate at which the nuclear power level can rise, the neutron flux may go well beyond 100% full power before the limiting circuit becomes effective. The reactor is scrammed as soon as the neutron level signal reaches a specified value above full power, such as 120 or 130%.

Period information is of primary importance when the neutron-flux level is low relative to the operating power level. During manual reactor startup, an automatic overriding system must insure that the reactor power level is increased at a safe rate. Thus, when the period drops below a specified value, such as 25 sec or less, control rods are inserted automatically until the period is restored within prescribed safe limits. When the period continues to decline to a shorter time, such as 10 sec or less, a hazardous nuclear excursion is indicated, and the reactor is scrammed.

Coolant-Flux Ratio Kept

The relationship of coolant flow to neutron flux level is maintained within a fixed range to prevent thermal damage to the fuel assembly and other reactor components. When the coolant flow drops below this range, a flux-flow comparator initiates automatic reduction in the neutron flux level until the neutron flux and coolant flow relationship is corrected. When full correction is not achieved within a predetermined time, or the reactor coolant temperature exceeds a predetermined value, the reactor is scrammed to avoid damage by thermal stresses.

Other safety criteria pertain to the several reactor types. In a pressurized-water type, a variation in reactor pressure from normal range actuates an alarm, alerting the operator to take corrective action. When reactor pressure drops below a predetermined value, scramming prevents boiling of the coolant and over-heating of the fuel elements.

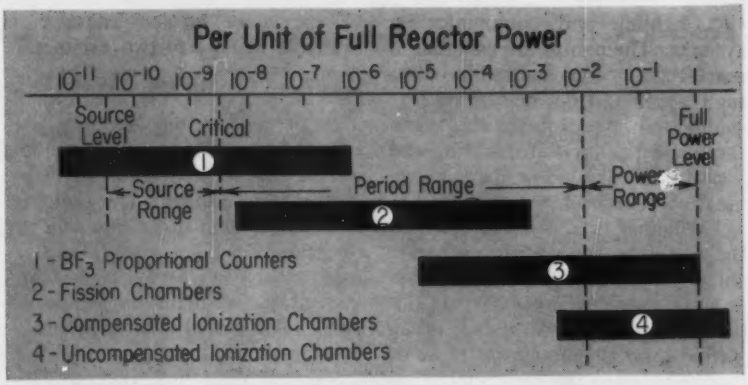


FIG 2—NUCLEAR INSTRUMENTATION for typical power reactor has the above effective ranges. Instrumentation for various operating levels is exemplified here

Control circuits and safety systems incorporate the maximum fail-safe features. The operator can always override automatic circuits to decrease reactivity or scram the reactor.

Radiation monitoring equipment detects equipment failures and insures positive warning of excess radiation or build-up of contaminating material endangering plant personnel or creating a hazardous environment. Each monitoring channel includes a detector, amplifier, computing circuit, a power supply, a means of calibrating, an indicating instrument or recorder, and alarm set points.

Monitoring equipment detects and evaluates rupture of fuel elements as evidenced by the release of fission products into the coolant system. A leak in a heat exchanger should be detected as early as possible to prevent continued contamination of the secondary steam system by the radioactive primary coolant. When detectors at the steam outlets of each heat exchanger detect a leak, the valves on the affected loop are closed.

In the water purification loops, radiation detectors should be mounted on the discharge lines of the ion exchangers for detecting when resin must be replaced. In the waste-disposal area, monitoring systems provide information for determining effluent hold-up time, safe effluent diffusion rates, and radiation level of particle and gas emission at the stack.

Health physics radiation monitoring equipment must be arranged for area coverage so as to warn whenever radiation in an accessible place exceeds the tolerance level. Radiation detectors are always close to the access hatches of any enclosed areas, enabling personnel to determine radiation level before entering.

The percentage of generation for station service from today's reactors ranges from 7 to 12%. The main coolant pumps for the primary loops may account for more than half of the total station power requirement. The basic station electrical one-line diagram conforms, for the most part, to conventional thermal plant practice.

Nevertheless special consideration must be given to providing a dependable power source for certain station loads. Continuity of station power reduces the frequency of scrams resulting from loss of power to auxiliary equipment. It obviates unintentional shutdown from voltage transients. Power supply is absolutely necessary to equipment essential to the reactor's safe shutdown.

Two loads are vital: Equipment for safe control during reactor operation, and equipment for shutting down the reactor and turbine plants safely. The former, such as pressurizer heaters, primary control, safety systems, rod drives, and rod-holding magnets, is best served by a power source free of electrical disturbances from other equipment systems or from switching. An electrical disturbance on the supply to such equipment could shut down the reactor.

Loads essential to safe plant shutdown are the main coolant or emergency cooling loop pumps, the turbine-turning gear and turbine-turning gear oil pump, and the sta-

tion lighting and communication systems. The pumps are essential to reactor shutdown. The turbine-turning gear and the turbine-turning gear pump are involved in shutting down the turbine generator. Lighting and communications allow safe movement of personnel.

Equipment for safe shutdown of the plant is served best by a separate shutdown bus. Normally, this bus is supplied from either of two station service transformers, or a station service generator with automatic transfer to an alternative source. A battery-driven motor-generator set and a diesel generator set can be used in an emergency to supply power for safe reactor shutdown.

An auxiliary alternator on the main turbine-generator shaft can replace the usual main dc exciter. This generator feeds an "Excitation and Vital Control Bus," isolated from other station auxiliary buses during normal plant operation. It affords a dual-function system, providing a reliable power system for excitation and reactor control when operating at load and a source of stored energy in the form of rotational inertia (WR^2) for an emergency shutdown. The energy system of the main turbine-generator is available equally to two exciters.

Auxiliary Service Isolated

After startup, the auxiliary generator system normally operates electrically isolated from the usual station service buses. Thus external electrical system disturbances affect the running exciter only to the extent that it disturbs the high-energy system of the main turbine-generator. Low-speed motor-generator sets need less maintenance than 3,600-rpm shaft-end exciters. Electronic systems are applicable also.

As the auxiliary alternator is a reliable power source normally isolated from the external power system in operation, it is an ideal power supply for equipment controlling the reactor, such as rod drives, rod-holding magnets, and safety systems.

When a plant is shutdown through loss of station power, the auxiliary alternator serves what is perhaps its most important purpose. The WR^2 energy of the entire turbine-generator system can be made available for an interim period to the shutdown bus for driving coolant pumps and make-up pumps vital to safe shutdown of the reactor. This auxiliary generator source is needed only when the diesel fails to start immediately.

Other stored-energy systems are alternatives to the main turbine-driven auxiliary alternator. These include separate motor-generator sets with added inertia, pumps with flywheels for added inertia, battery-driven motor-generator sets, a synchronous condenser of high inertia, and a separate turbine-generator set to operate from residual steam in the thermal system.

The nuclear plant confronts the electrical engineer with new material-selection problems also. High-energy radiation can induce pronounced changes in the physical and electrical characteristics of components of the reactor electrical systems. Insulators, vacuum tubes, transistors, and other electronic components are susceptible to radiation damage.

MI-type cable withstands a high radiation level. Work is progressing on the development of inorganic compounds, such as silicon resin-coated glass fibers. Because of the radiation shielding designed into nuclear plants for biological reasons, standard types of insulation and electrical components are satisfactory in most plant areas.

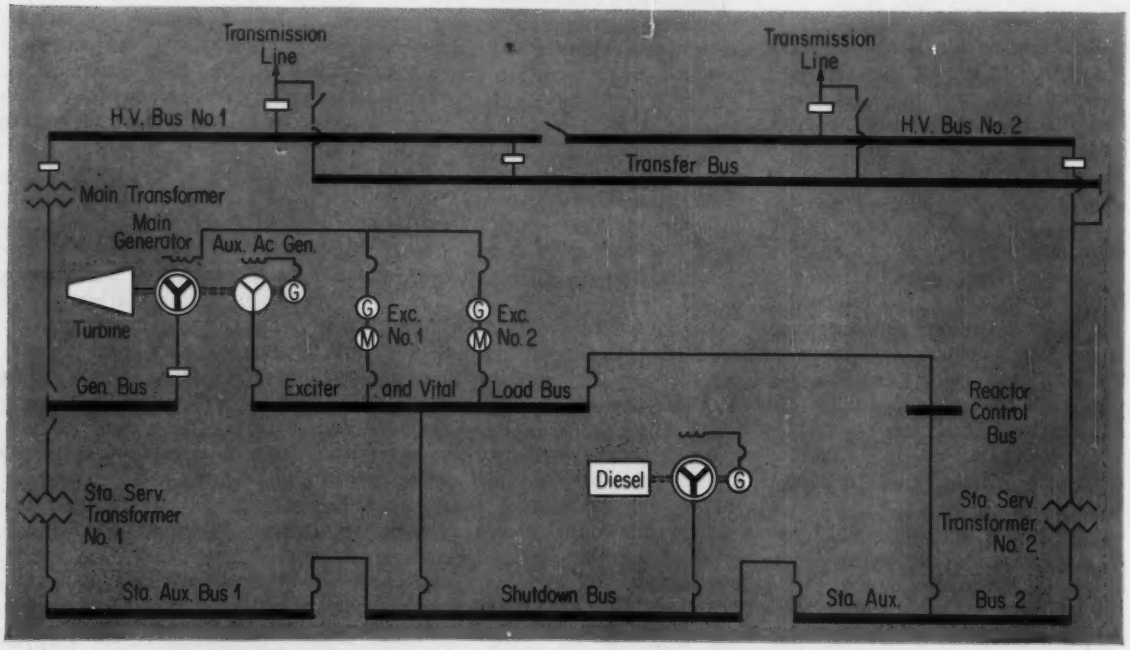
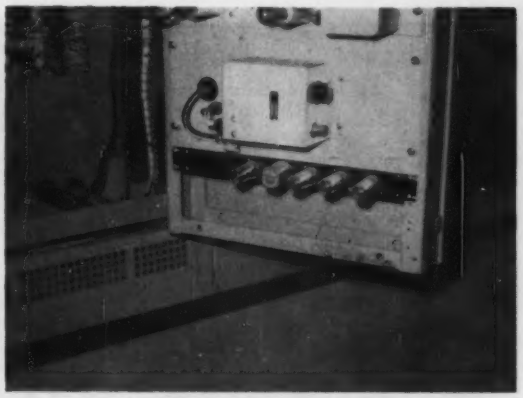


FIG 3—EQUIPMENT essential to safe shutdown is best served by a separate shutdown bus, as shown in this proposed basic station electrical one-line diagram. Normally, this bus is supplied by either of two station service transformers



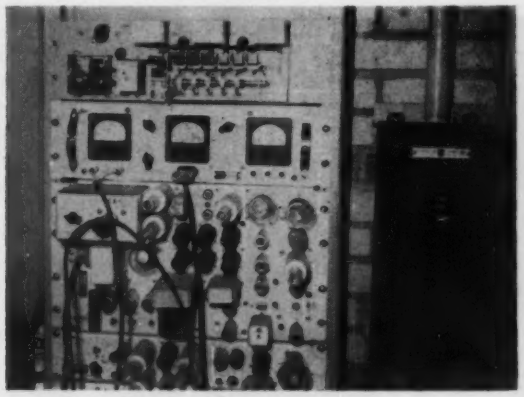
Check Back Unit

With the rapid growth of unattended substations has come the need to test carrier current protective systems remotely. These routine tests formerly were carried out by the substation attendants.

This need is being met by the devices pictured above: The check-back unit and the master-check unit. Working as a team, they test carrier current transmitters and receivers automatically at unattended substations. They require a minimum of change of existing circuits, panel arrangements, and operating procedures.

They are small and can be mounted in spare rack space usually available in the carrier cabinet. The units are relatively inexpensive and use standard, readily obtainable components.

The check-back unit, for remote unattended carrier terminals, can be mounted inside the carrier cabinet.



Master Check Unit

It is designed for standard 19 in. rack and panel construction. It measures 1¾-in. wide and 19 in. long. It has four plug-in terminal time-delay relays with four calibrating potentiometers and one or two plug-in telephone-type relays. A second telephone-type relay may be used for carrier sets requiring the opening of a circuit to start transmission.

The master-check unit notifies the system load dispatcher's office if the check-back unit finds a bad tube or component. It consists of two synchronous motor-driven timers and four or five plug-in telephone-type relays. These devices are mounted on a panel 5¾ in. by 19 in. The panel occupies three rack units of space.

How these devices combine to help you avert unnecessary line-tripping is described in the accompanying article.

NSP Sidesteps Carrier Trouble

- **Two robots developed to test carrier-current protection at unattended substations**
- **If bad tube or component is detected, an alarm is dispatched automatically to system operator's office**
- **Operator can make test at his discretion, otherwise the system automatically runs a check for him every 8 hr**

L. C. LaTOURETTE, Pioneer Service & Engineering Co, Chicago, Ill., and
K. K. DOLS, Protection & Operations Section, Northern States Power Co, Minneapolis, Minn.

An electronic detective that finds latent trouble at unattended substations has been developed to improve service continuity of lines protected by carrier-current systems.

The "detective" is a combination of two carrier-current testing units: A check-back device developed by Northern States Power Co, and a master-check device developed for Northern States Power by Pioneering Service & Engineering Co.

The two automatic units test carrier current equipment every 8 hr at remote substations and report automatically to the load dispatcher if something is wrong.

The idea is to head off unnecessary tripping of circuits because of the "fail safe" characteristic that is built into carrier-current equipment. This is accomplished to an effective degree when the two units work as a team.

Although the units are designed to operate automatically, they will run a quick test whenever the attended substation's operator commands them to.

The "check-back" unit tests all carrier-current transmitters and re-

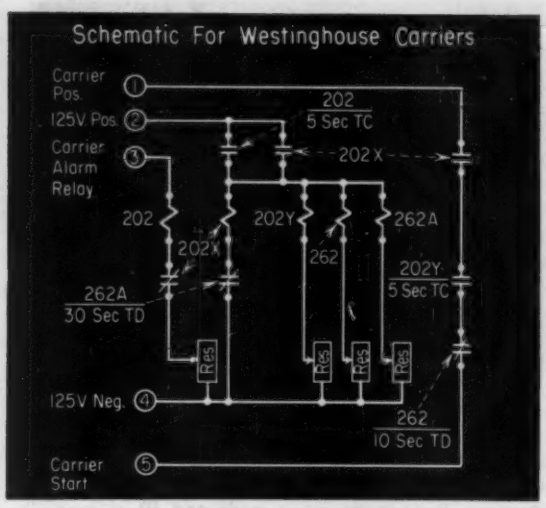


FIG 1—When check-back unit receives query signal, it triggers answer by operating relays 202X, 202Y, and 262

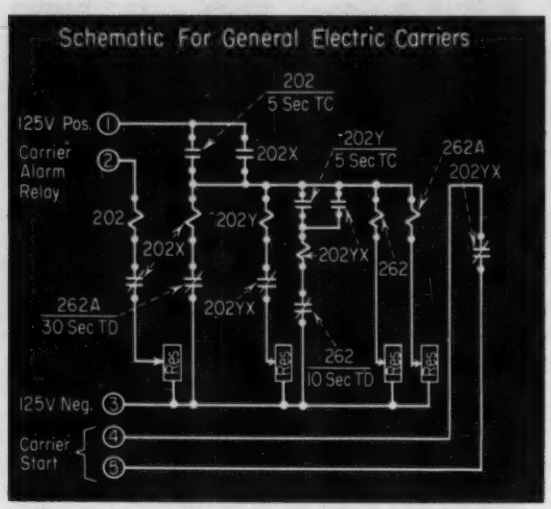


FIG 2—If reply transmission requires the opening of a circuit, check-back unit is modified with relay 202YX

ceivers on a two- or three-terminal line, even though the remote terminals may be unattended.

The "master-check" device automatically warns the system load dispatcher if the check-back unit detects a tube or component failure. Then a manual check of each involved carrier set is made to find the trouble before an unnecessary outage occurs.

Local Transmission Stopped

Here's how the check-back unit works:

The test starts with a 5-sec continuous signal from the carrier transmitter in the attended substation. This signal is longer than those used for relaying or communication. The check-back unit responds accordingly.

When the operator first starts the test, a milliammeter in his carrier relaying receiver circuit registers a received signal—feedback from the local transmitter. To avoid confusion between this feedback signal and the signal anticipated from the remote transmitter, an additional 5-sec time delay is introduced. This gives the operator a chance to stop local transmission before the remote transmitter replies.

At the remote terminal or terminals, a relay in the carrier receiving circuit energizes thermal relay 202 upon receiving the 5-sec query signal (Fig 1). This is a timer in the carrier check-back unit. Contact of 202 will close if the received signal continues for 5 sec. When its contact closes, instantaneous relay 202X operates and seals in until reset by 262A. Simultaneously with operation of 202X, thermal relays 202Y, 262 and 262A start timing.

The carrier reply is to be triggered by the closing of 202X and 202Y contacts and is to be interrupted by the opening of 262 contact. At Terminal 1 shown in Fig 1, thermal relay 202Y times out 5 sec after relay 202X operates. This starts a reply transmission. In another 5 sec, 262 times out and opens its normally closed contact to break the reply transmission.

Signal Indicates Normalcy

During this 5-sec interval, if all transmitters and receivers are working properly, the operator at the attended station will receive a signal indication on his carrier milliammeter.

If the carrier channel being tested is a three-terminal line, at remote terminal 2 thermal relay device 202Y is adjusted to close its contact 15 sec after relay 202X operates—or 5 sec after the transmitter at remote terminal 1 has completed its check-back. Similarly thermal relay 262 at remote terminal 2 opens its normally closed contact to stop transmission 5 sec later, 20 sec after 202X operates.

The operator at the attended station thus receives each 5-sec check-back signal in sequence with a 5-sec delay between signals.

Return to Normal

At each remote station thermal relay 262A is adjusted to time out 30 sec after it is started by 202X. Relay 262A opens its normally closed contact causing 202X to reset, which in turn opens the circuit to relays 202Y, 262, and 262A, and all devices return to normal.

When used with carrier sets requiring opening of a circuit to start the carrier transmitter, this unit is equipped with an additional instantaneous relay device 202YX (Fig 2).

Operation is similar to the one described except that operation of 202Y causes 202YX to operate and seal in. Relay 202YX in turn opens the carrier start circuit to trigger transmission.

If this check-back unit is used on carrier sets which also are used to provide a supervisory control channel, the initiating impulse originates from the time delay relay in the supervisory set.

If the same carrier receiving relay

is used to start the check-back unit and deliver pulses to the supervisory equipment, the short supervisory pulses will be thermally cumulative in timing relay 202 and might start the check-back cycle on supervisory impulse.

This is avoided by having the supervisory equipment provide a circuit that closes only when a carrier signal of longer duration than a supervisory impulse is received. This circuit starts relay 202 in the check-back unit.

When carrier communication is also used, telephone instruments have their hook switches or plug-in jack springs arranged to open the circuit to relay 202 when the telephone instruments are in use.

Master Check Unit Is Automatic

The master check unit, Fig. 3, consists of two synchronous motor-driven timers and four or five plug-in telephone-type relays. The fifth relay is required only on three-terminal lines.

The first timer (device 66 in Fig. 3) is continuously running and initiates an automatic check cycle every 8 hr. The second timer is a single-cycle, 50-sec unit with six cam-operated switches, one of which controls the timer motor. The other five control cams are adjustable both as to the point in the 50-sec cycle that their associated switches operate and as to the duration of the switch operation.

This master check unit overcomes the objection to semi-automatic check-back operation of carrier equipment which requires too much of the system load dispatcher's time where a large number of terminals on the system need to be checked.

The master-check unit was designed for operation with the check-back device already described, and with existing supervisory and carrier control equipment. It was installed on the Twin Cities system of Northern States Power Co. It required a minimum of change in existing circuits and in existing supervisory control dispatching procedures.

The installation on the Twin Cities system gives the system load dispatcher an automatic indication of faulty carrier current equipment at any of the terminals in the area. There are over twenty-five 115 kv transmission line sections in the area protected by carrier pilot relaying. Supervisory control is provided for most of the 115-kv circuit breakers.

As part of this check-back system, the dispatcher is given control and indication of a mechanically latching, electrically operated "on-off" relay, 283C in Fig 3, with each 115-kv line breaker under his control. This replaces the conventional carrier "on-off" control switch usually supplied with carrier relaying equipment. It supplements the circuit breaker control and indication.

With this installation, the process of checking carrier equipment at all terminals on the system covered is made as automatic as possible. The dispatcher is alerted when failure of a piece of equipment is detected. The automatic-check cycle is initiated once every 8 hr. But the dispatcher can check by supervisory control at any time.

If, when the check cycle shows faulty equipment (either automatically or when operated by the dispatcher), the carrier "on-off" relay 283C is tripped to the "off" position. This places the protective relays at the master terminal on non-carrier, or back-up operation. The dispatcher receives a supervisory indication that relay 283C has been tripped to the "off" position. He can then, by supervisory control reoperate relay 283C to the "on" position which will cause relay 201CB to operate and initiate another check cycle. If the recheck still shows faulty equipment, relay 283C will trip again. The dispatcher then, by supervisory control, may trip carrier "on-off" relays 283C at the other outlying terminals associated with the master terminal. All relays looking toward the line in question will then be on non-carrier or back-up operation.

Check Made Automatically

As you know, facilities long have been available for checking carrier equipment at attended substations. And equipment has been at hand for testing an unattended carrier terminal when a test signal is sent by the operator of an attended substation. But this equipment is semi-automatic and requires the operator's time and attention during the tests.

The check-back and master-check units, combined with supervisory controls, give to the load dispatcher an automatic indication when a carrier tube or other component becomes defective. He can then take steps to determine what part needs replacing. The load dispatcher does not have to concern himself with checking for faulty equipment. The check is made for him automatically.

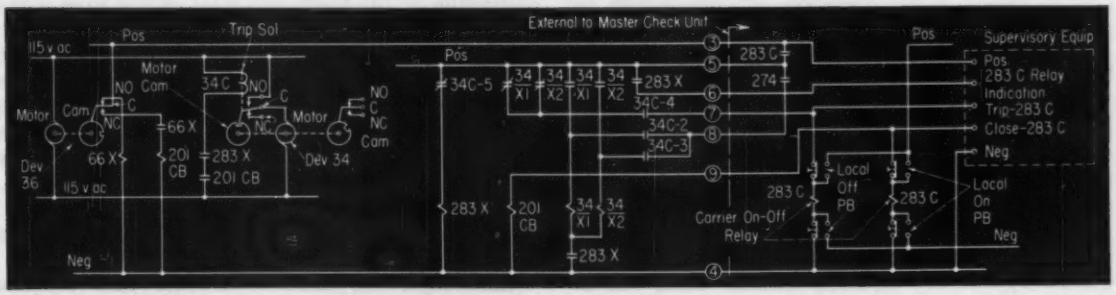
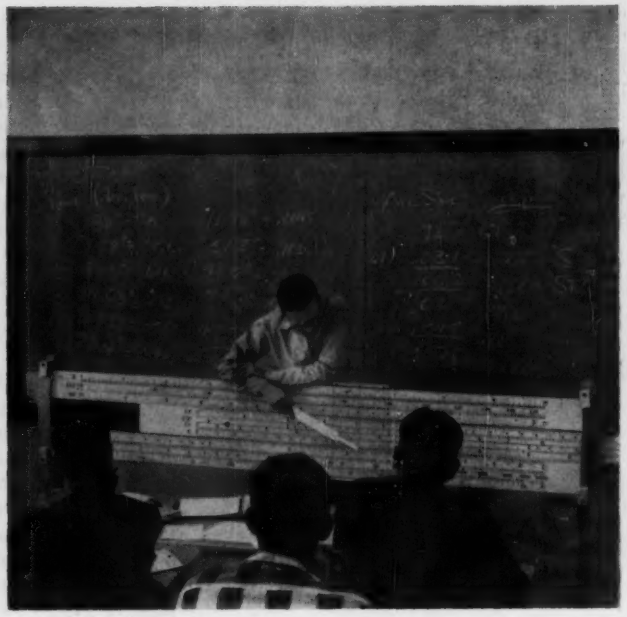


FIG 3—Master-check's purpose is to initiate carrier tests every 8 hr and report any failures detected by check-back unit. The device is designed also for application to existing supervisory and control units with local manual control

Students learn warehousing . . .



the workings of the slipstick . . .

How to Train an Engineer's

E. W. LOVE, Training Supervisor, Southwestern Public Service Co, Amarillo, Tex.

In graduating its first class of engineering estimators, Southwestern Public Service Co has taken a step toward easing the routine loading of its professional engineers.

The company is sponsoring a 16-week full-time Engineering Estimator School which turns out technicians who can serve as professional engineers' right-hand men in both field and office. Somewhat similar to the engineering assistants of other utilities, these trainees undergo a 638-hour program covering a wide range of engineering and non-technical subjects.

Fourteen graduates of the school are now in new jobs under direct supervision of graduate engineers. They are assigned to key locations throughout the 45,000 sq mi service area in Texas, New Mexico, Kansas, and Oklahoma. Their routine technical tasks, although vital to smooth utility operations, do not require the graduate engineer's education and experience.

Program Frees Engineers of Routine Duties

The program's philosophy is that such routine can be released to a well-trained technician. An engineer will no longer have to drive a hundred miles to collect load study data; his estimator will secure and organize the data for his final decision. On short pole extensions, the estimator will gather facts for the legal right-of-way description. He will make a preliminary job survey, prepare sketches, estimate costs, and do much of the paper work. The estimator will take over many routine reports, such as substation transformer loading, individual customer load studies, and gathering of fault current calculation data.

The men selected for the estimator course came from within the company. They represented a wide range of skills: journeymen or apprentice linemen, groundmen, warehousemen, draftsmen, or engineering estimators. (In the past, estimators did not receive formal training.) Applicants were chosen from male employees on a basis of aptitude tests, interviews, and supervisory recommendations.

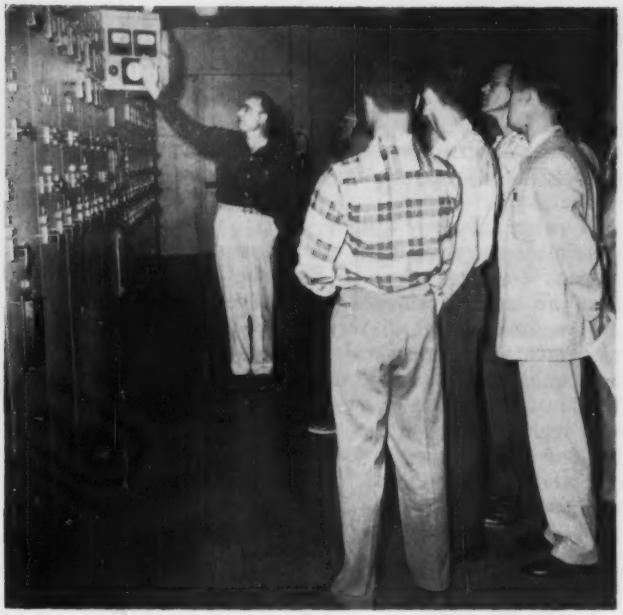
To other non-professional employees, such a program symbolizes progress. Although only 14 were chosen initially, there is a general feeling that such company thinking offers each man the opportunity to advance according to his ability.

Company Engineers, Managers Teach Trainees

Long before the school opened, the courses were outlined in detail. Instructors were chosen from within the company on a basis of education, teaching experience, and knowledge of the subject. Generally, engineering subjects were taught by instructors from the company's plant and lineman's vocational schools. Managers and department heads taught non-technical courses, such as rates and budgets, customer relations, and FPC accounting.

Before school began, each instructor submitted a detailed subject outline. He also prepared formal lesson plans for each class period.

Classrooms and cafeteria facilities were provided by Amarillo College, where the campus atmosphere and college pattern were well suited to the concen-



switching and clearance procedures . . .

and handling of protective equipment

Right-Hand Man in 16 Weeks

trated curriculum of the estimator course. Because the school met the requirements of the college's community service department, each student received a completion certificate from the college as well as the utility.

The students attended school from 8 AM to 5 PM, Monday through Friday. Class sessions ranged from one to two hours, with four-hour drafting periods. Two daily supervised study sessions kept homework to a minimum.

Special emphasis was placed on restricting the course material to that theory essential to the engineering estimator's job. Although the courses were often of an advanced nature, they did not compare with advanced college engineering.

Instructors were required to maintain accurate grading systems and attendance records. Grades and instructor's comments were forwarded to the new graduates' supervisors as a guide in the man's development.

Formal Graduation Exercises Held

To emphasize the company's faith in the engineering estimators and the school, formal graduation exercises were held. Graduates, instructors, guests, and their ladies were invited. Dr. A. M. Meyer, president of Amarillo College, awarded certificates.

The company feels the measure of the program's success awaits the test of time. However, all indications point toward a bright future for both the program and the engineering estimators. And graduate engineers, freed from routine, should find new fields of opportunity.

Curriculum Covers Wide Range of Subjects

	Hours	
Basic Principles		95
Mathematics	24	
Fundamentals of Electricity	23	
Principles of Electric Utility Systems	24	
Advanced Princ. of Elec. Utility Systems	24	
Drafting		64
Construction Standards		83
Drawings, Assemblies & Grounding	41	
Material Identification & Selection	21	
Metering	21	
Accounting Procedures		73
FPC System Account Numbers	21	
Improvement Requisitions	14	
Misc. Company Forms & Records	38	
Miscellaneous Subjects		
Customer Relations Training		21
Slide Rule		29
National Electric Safety Code		21
Rates & Budgets		21
Relays & Switching Procedures		21
Surveying & Mapping		65
Supervised Study Periods		145
Total Hours		**638**

Transients Trouble Suburban

Outages of plants outside load centers are traced to excessive control sensitivity

CHARLES E. QUICK, Industrial Power Planning Engineer, Detroit Edison Co, Detroit, Mich.

When industrial plants new to suburban areas complained that power system transients disrupted operations, Detroit Edison Co traced the trouble to the controls on the plants' automated machinery.

These controls, it was found, are more sensitive than they need to be for satisfactory equipment performance. Their designers had assumed that power supply would be absolutely continuous at a practically constant voltage, a condition which cannot be assured by power supply systems to heavy loads away from heavy-load centers.

Complaints came to Detroit Edison in increasing numbers first in 1952, and there were further increases in 1953 and 1954. They came almost exclusively from plants in the suburbs. Although more interruptions had been foreseen as a concomitant of power line exposure in such areas, many plants had difficulties when the power supply remained intact.

As all these customers had new plants with new equipment, it appeared probable that the new equipment had elements responsive to system disturbances other than interruptions. Accordingly, the characteristics of the affected equipment were very carefully evaluated.

A power company usually serves a centralized industrial area from a very "stiff" system. Generating stations are often close to the load, and overhead lines are multiple wherever practicable. Underground cables serve areas of very dense load. Overhead circuit outages come mostly from public interference and equipment failure, and those underground from the latter cause alone. The degree of service reliability is very high.

Load concentration is low in suburban areas when an industry locates there. Service is and will remain overhead for years. As a rule there is no multiplicity of lines. Except for very large loads, service is from 23 to 69-kv sub-transmission lines, emanating from transmission step-down or generation step-up stations.

Economics dictate not only the design, but also that a number of sub-transmission lines be served from a few high-capacity transmission lines. The sub-transmission lines are often on public right-of-way, where hazard is great from traffic and other public interference, and adequate tree trimming difficult.

A comon power-company arrangement has a sub-transmission bus in several sections separated by a normally closed section breaker. Each line has its circuit breaker. Although this arrangement affords the

Voltage Regulator Stabilizes

FRANK X. DORAN, Supervisor, Electrical Engineering Section, Plant Engineering Dept., Ford Division, Ford Motor Co, Dearborn, Mich.

One "corn-field" or rural plant experienced system transients varying from 2 to 80% of normal voltage for 2 to 90 cps. The effect of these transients was observed when machinery and equipment controls became de-energized without any apparent dimming of plant lighting. Normally, the restarting time for most of the equipment was about 4 hr, which represented a loss of 4,000 man-hours of plant production.

Although such power system disturbance is only momentary and takes an oscillogram to detect it, it may interrupt plant production for several hours. At one plant, transient conditions occurred three to five times a week during certain seasons, and immediate corrective action was necessary. The situation led to meetings between the plant operator and the public utility serving the plant.

Recording instruments at the plant showed that controls became de-energized without any evidence of reduced voltage on the meter charts. On this basis the utility intimated that the problem was the plant's. But subsequently voltage oscillograms showed that the plant's problem, after all, was definitely attributable to transients of varying magnitude and duration. In attempting to find a solution, the plant explored several approaches.

Tests, made by setting a Variac at a predetermined voltage and bypassing it by means of a switch to furnish normal voltage, showed that the drop-out point of relays and motor starters varied from 40 to 70% of normal voltage. The transient condition was simulated by opening and closing the switch quickly.

Among surprising findings was that like pieces of equipment, built by the same manufacturer, varied as much as 10% in drop-out characteristics. Changing "normally open" and "normally closed" contacts on relays varied the drop-out voltage as much as 20%.

Coil Modifications Tried

Control manufacturers were asked to design equipment capable of remaining energized above 25% of normal voltage and, in view of the large amount of equipment in service already, the plant engineers proposed a change of coil design only. The control manufacturers approached the design problem in various ways.

One installed a permanent magnet on the contact mechanism; another re-wound coils to reduce drop-out

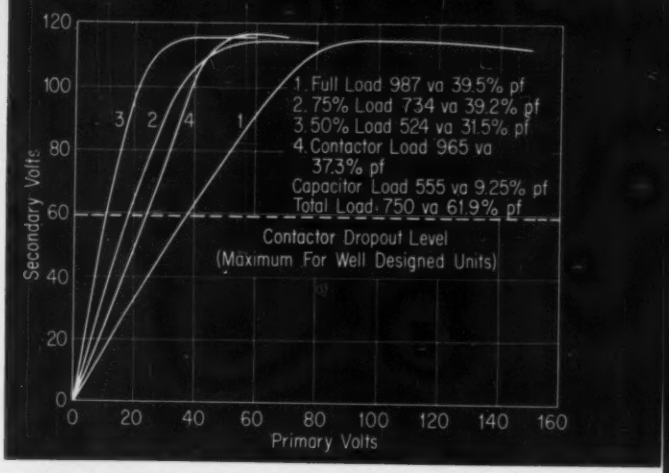
"stiff" system for serving today's industrial loads, it leads directly to a voltage dip problem.

For every fault on every line served from a bus, bus voltage decreases or dips for a duration equal to the relay plus breaker operating time. The dip magnitude is a function of the fault impedance and—for line faults—varies inversely with the distance from the station.

Normally, relay time is a function of fault current. It is in the order of 1 cycle for faults at or near the station which produce dips of 75% or greater. For lesser faults, usually those remote from the station, it may be as long as 25 cycles, magnitude of the dip being in the order of 20%. For faults at intermediate points, relay time decreases and the magnitude of the voltage dip increases as the station is approached.

Modern high-speed breakers open in as little as 2 cycles. Many on the Detroit Edison system open in 4 to 5 cycles but, being relatively new, cannot be retired economically. Some older but serviceable breakers open in 6 to 7 cycles. Thus, the sum of the relay and breaker times for heavy faults ranges from about 3 to 8 or 9 cycles, and may be as much as 30 cycles for lesser faults. Accordingly, it will be many years before it becomes economically feasible to reduce the duration of voltage dips substantially.

Detroit Edison took steps to determine the sensitivity of the driving motors of various machines in suburban plants. Some motors withstood greater voltage dips or dips of longer duration than others. Tests were made on such automatic machines as a screw, a lathe, and a turret lathe, all driven by 30 to 50-hp a-c motors.



EFFECTIVENESS of 1-kva constant voltage transformer in limiting control voltage dips varies with control-circuit load

By minor connection rearrangements, voltage dips of various magnitudes and durations were applied to the motor feed, full voltage being maintained on starters and control relays. With dips as great as 90% for as long as 30 cycles, there was no damage to either the work-pieces or the tools.

Were they not cooperating in the tests, operators

(*Continued on page* 58)

Automated Plant Operations

characteristics to 31 to 38% of rated voltage. In the latter case, coil life expectancy was reduced to less than half that of a normal coil. All control manufacturers suggested the use of dc coils which could be wound to drop out at any desired voltage. This measure was prohibitive in cost.

A motor-generator set with a high-inertia fly-wheel was found to be prohibitive in cost also. The response of voltage regulators was too slow, and the regulators did not cover the range through which the transient condition existed.

The control manufacturer's engineers and electronic division coordinated their efforts in designing a voltage regulator rapid enough in response and adequate in range to accommodate the transient conditions encountered. Tests indicated that the device would meet requirements for stabilized voltage on the control equipment. A cost analysis put the original investment at less than 30% of the cost of a motor-generator set. When the stabilizers are part of the original installment, in lieu of control transformers, the increase in cost amounts to only 10%.

Computer Requirements Vary

A 12-month trial has given convincing evidence that voltage stabilizers installed on essential production equipment perform satisfactorily. They have since been installed on all production equipment and on building and plant facilities. Their satisfactory performance has led to their installation in plants in various geographical locations on an experimental basis. All proved satisfactory.

At the plant, troubles with electronic computers pointed to low voltage which investigation showed was a transient condition. Voltage stabilizers were installed and have operated satisfactorily for 18 months without interruption attributable to transients.

When another computer, built by the same manufacturer but of a different functional type, was installed, it was equipped with a voltage stabilizer for eliminating trouble caused by transient voltages. But after less than 30 days of operation, it began making errors. Investigation showed that the output wave shape of the voltage stabilizer affected this particular equipment. A voltage stabilizer, incorporating harmonic filters, was the solution.

Some major utilities are being polled on the power system conditions a plant in outlying areas may expect, and computer manufacturers will be asked to design their equipment in conformity with normal utility operational conditions.

probably would not have noticed the effect of dips on their machines. The test results led to the conclusion that controls on many machines were much more sensative to dip than was required for protection of the machines or work-pieces.

Complaints had cited magnetic chucks, motor starters and low-voltage releases, gas-fired oven controls, automatic machine controls, and mercury lighting. The company studied the characteristics of each. One fact stood out very early: Equipment builders assumed an absolutely continuous power supply. One even said:

"We have to assume the power supply is continuous. We have enough problems trying to make the mechanical parts of our machines function properly."

Control-component makers admitted that they had not considered protection against very brief interruptions. Most said: "We meet NEMA standards." The only NEMA standard for control equipment states simply that a-c contactors shall withstand continuously 110% of rated voltage and shall close successfully at 85%. Dropout is not mentioned.

Drop-out Points Vary Widely

Each principal control contactor manufacturer was asked to supply data from laboratory measurements of time and percentage voltage for dropout. Three furnished complete data, some of which appeared to be design rather than laboratory data. Characteristics of contactors made by several vary considerably. Contactors rated 10 through 50 amp may have a drop-out voltage as high as 74% of normal and drop out in ½ cycle for lower voltages. The same size contactors of two other manufacturers drop out at 50 to 25% voltage in 1¼ to 2 cycles. All three manufacturers agreed that drop-out time is independent of voltage except for the very narrow region about the drop-out point.

A study of high-intensity mercury lighting showed that performance varies considerably for each manufacturer's equipment, and for the specific arrangement and operating conditions of the equipment of any one manufacturer. But practically all such lamps drop off in 2 cycles at dips greater than 50%. The lamps of two manufacturers normally withstand dips of 25% for many cycles, but those of a third withstand dip of not more than 15%. As many large industrial plants use high-intensity mercury lighting unsupplemented by incandescent lighting, the 4 to 8-min restarting time after a voltage dip of about 3 cycles can seriously affect production and safety.

A major voltage dip over ½ cycle could release work from an electro-magnetic chuck of a low permanent magnetism. An inexpensive dry battery rectifier device has been designed to provide automatically a continuous current to a chuck when normal supply fails.

Automatic shutoffs on gas-fired ovens and furnaces prevent the formation of explosive mixtures of gas and air when power fails to electrical drives of gas generators or blowers. Some control valves on such equipment are sensitive to voltage dips as brief as 2 cycles. Manufacturers intimated this sensitivity is usually not needed for safety of personnel or work-pieces.

Automatic computers and data-processing machines, performing hundreds of operations per second, are extremely sensitive to even 1-cycle voltage dips. Protection from voltage transients must be designed into them, as such sensitivity is not compatible with practical power system design.

Detroit Edison investigations established that the controls of automatic machines and gas-fired ovens are more responsive to very short power breaks than the protection of machines and ovens warrants.

Motor starters can be protected by time-delay, drop-out devices, which cannot be applied to control contactors as the time delay would actually defeat their operating function. A manufacturer who made tests on permanent magnet hold-in devices for incorporation into each contactor, found the reliable operating life inadequate for modern production equipment.

M-G Set Cost Prohibitive

A motor-generator set for supplying control voltage minimizes voltage fluctuations at the control contractor, and maintenance of satisfactory voltage can be extended for several seconds by the addition of a proper fly-wheel. Motor-generator sets, however, are bulky, expensive, require maintenance, and are practical only where the output voltage must be kept very close to the normal value for very large voltage dips or momentary interruptions lasting several seconds. They appear not to be needed for the controls of today's automated production lines, although they are very desirable for some data-processing machines.

The constant output-voltage transformer, using a fixed capacitance and an iron-core inductance in the load winding, is a simpler means of providing satisfactory voltage to control contactors. This device functions normally to maintain a very constant load voltage for a source variation of about 15%.

Tests show that, when such a transformer is operated at 75% load, an 80% drop in source voltage results in only a 40% drop in load voltage. When the load is half the rated value, the 80% drop in source voltage produces only a 9% drop in load voltage, and 60% load voltage is maintained through an 88% dip.

This transformer functions within ½ cycle and maintains ratio indefinitely. As most control contactors hold in at 50% voltage, this type of transformer can be used in series with, but preferably in lieu of the normal control transformer for protecting almost all control contactors. Slightly larger than standard transformers, it is relatively inexpensive and needs no maintenance.

The constant output-voltage transformer eliminates also the outage of high-intensity mercury lighting responding to voltage dip. The relative cost, in this application, however, is somewhat higher, as the allowable voltage variation is so small as to require not more than half of rated load on the transformer.

In some circumstances, 440-cps control equipment can be used, the normal 60-cps power source having been converted to 440 cps by a fly-wheel motor-generator. At a large, compact installation, needing very constant voltage, savings in material could at least compensate for the added cost of the motor-generator set. This approach makes fluorescent lighting competitive with high-intensity mercury lighting.

METER ACCURACY PROTECTED

by quality socket

Today's improved meters demand a mounting that will help sustain high accuracy and help protect meter life over a period of 30 years or more. No matter how accurate the meter—a poor quality socket can mean less dependability . . . meter failures and lost revenue.

To help meter men protect today's quality meters with a genuine quality mounting, General Electric designed the rugged S-1 Square Meter Socket. It's designed specifically to help protect meter performance over the life span of the meter it serves. Made of strong, lightweight, die-cast aluminum, the S-1 is easy to install. It has external hubs, large inside working space, lay-in type terminals requiring only 45-degree wire bend. You get true versatility from the S-1 since it comes with two, one, or no hubs, pre-scored positive knockouts and it can be mounted either vertically or horizontally by simply interchanging terminals 90 degrees.

You get safety protection with a choice of lay-in bus-type or serrated strap terminals—both with positive ground. For the life of a meter, the rugged, weather-tight construction of the S-1 gives solid protection from severe weather conditions. The long-life dependability of this versatile 100-amp capacity socket provides real protection for your investment in meter accuracy. Ask your General Electric Apparatus salesman—he'll be glad to show you the facts, or write to General Electric Company, Section 628-1, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Board Speeds Polyphase Meter Tests

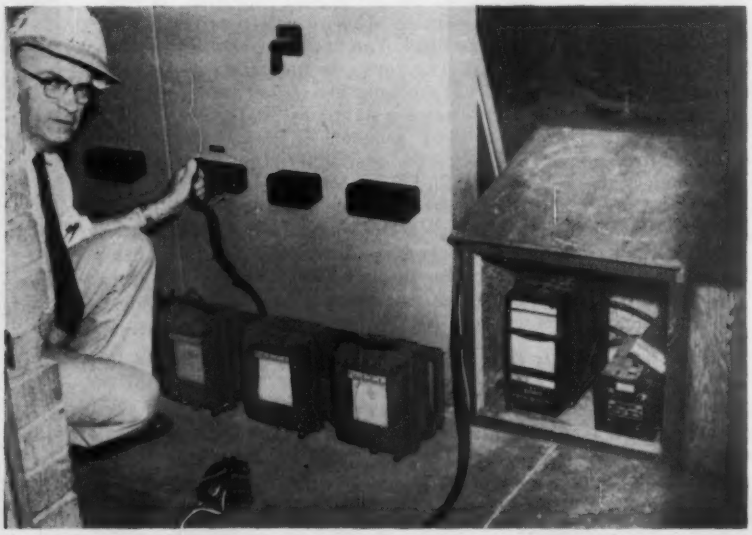
W. H. FARRINGTON, Texas Electric Service Co, Fort Worth, Texas

The volume of polyphase meter testing prompted Texas Electric Service Co to devise a more efficient, gang-test method to handle the increased production. One man can operate the new test board; the new method shows a gain of from 50 to 100% over conventional single-position testing.

In the new method, the new test board and racks provide an all-purpose watthour and demand meter test board. The rolling rack has two sides. One side is wired for 7-terminal, S-base, wye or delta meters; the other for S-base, 8-terminal, 3-wire, 3-phase meters. All No. 1 current positions are in series and brought to terminals at either end of the test table. At one time, 12 meters may be tested, three rows of four meters each. In testing four meters, top-row positions are used. The two bottom rows test eight.

Flexible leads connect the test rack to the test table; a ground bonding conductor also runs from the test table to the test rack. Two test racks, with 21 positions each, were built for testing 3-wire, single-phase, watthour thermal demand meters. Current coils are in series; potential coils in parallel. The test board is so constructed that one meter rack can be in warm-up position while the other is in use. It can be used for single-position testing and has breakdown test facilities.

In developing the new from older equipment, the photo-electric counter was slightly modified. Some taps on the rotary step relay were changed to make available additional number of revolutions. A counter doubler was installed to count more than 40 revolutions on light-load runs. The new test board is designed to cut off the current as well as the potential to prevent creep. Its racks are adjustable for leveling the meter disks to prevent creep caused by the natural unbalance of some disks.



Portable Units Economical for Feeder Checks

J. N. VINES, Engineer, Distribution Section, Iowa Power & Light Co, Des Moines, Iowa

Portable recording instruments with a convenient plug-in device enable Iowa Power & Light Co to keep abreast of rapidly changing feeder loads. This practice, replacing the use of permanently installed meters on each feeder phase, considerably reduces the number of

(*Continued on page* 63)

Here's why Wagner Form W Transformers are

EASIER TO INSTALL . . . GIVE LONGER SERVICE LIFE

The small size and light weight of Wagner Form W Transformers makes them easy to handle—easy to mount on poles. Smooth, rounded lifting lugs—chuck type terminals with insulated hand knobs—key-locked bushings all combine to make installation easier.

These transformers give longer service life because of their liberal design that gives excellent electrical performance with high overload capacity to handle peak loads—their air-tight cover seal that prevents oil contamination—their electrically welded tanks and durable paint finish.

A few of the features of these modern distribution transformers are shown below.

HIGH VOLTAGE SIDEWALL BUSHING

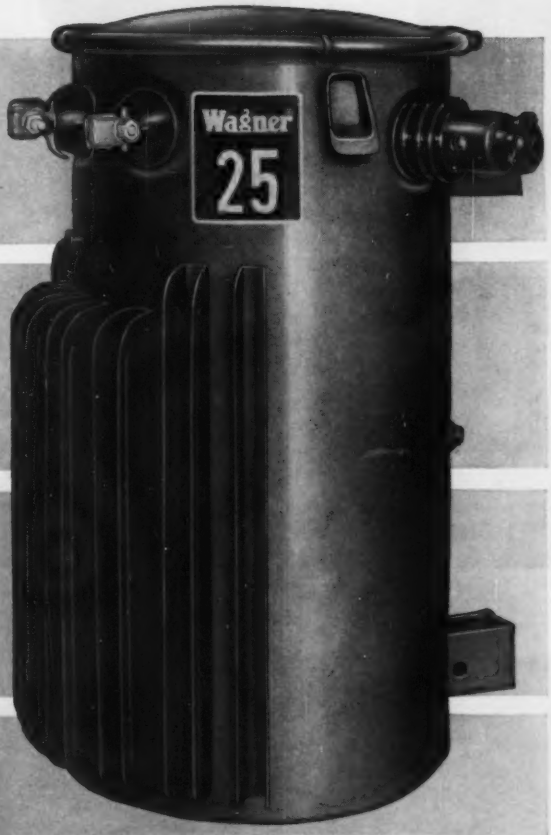
Permits faster, safer connections because chuck type terminal eliminates need for tools, and insulated hand knob protects lineman when tightening terminal. Takes either copper or aluminum conductor. (Used on transformers 5 KV and below.)

LOCKED LOW VOLTAGE BUSHING

Bushing and terminal are double locked to prevent slipping or turning when terminals are tightened. No loose inner terminal connections to cause short circuits.

SHUR-SEAL COVER CLAMP

Seals tank cover airtight . . . no atmospheric moisture or dust particles can get inside to contaminate oil and shorten transformer life. No oil can leak out during shipping or handling.



FORM W ELEMENTS

Cores of cold rolled oriented grain transformer steel are assembled through and around the pure copper coils. Thermo-setting insulation bonds coil element into a solid unit, which is braced to prevent any possibility of shifting.

Wagner Form W Transformers are available in single-phase ratings, 500 kva and smaller, 69 KV and below, in conventional or protected types. All ratings from 3 to 167 kva, 15 KV and below, are designed for pole mounting.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

WT58-3

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

A MAJOR ACHIEVEMENT IN POWER

the new C-D 100

Another C-D first!

CORNELL-DUBILIER announces the first individual capacitor unit rated to deliver a full 100 Kvar. It is available in standard voltage ratings of 4800, 6640, 7200, 7620 and 7960 volts.

Because it reduces by one-half the number of (50 Kvar) capacitors required for substation racks and pole-mounted banks, these 100 Kvar units occupy less space and cut installation and maintenance costs.

All of the advanced features exclusive with C-D power-factor capacitors – including the lowest volts per mil (333 v.) and power losses considerably below the NEMA limit of 3⅓ watts per Kvar are incorporated. Every unit is factory-energized for hours at full-rated voltage as a final quality check.

Insure low-maintenance service from your next power-factor installation, by talking it over first with a C-D engineer. Just write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J. Dept. D-28.

CORNELL-DUBILIER CAPACITORS

CORNELL-

FACTOR CORRECTION...

The power factor
capacitors that
give you better than
99.6% trouble free
DUBILIER service!

Checking Feeder Loads

(*Continued from page* 60)

meters required and the investment that would be entailed.

The recording meters are mounted in sets of three on light metal frames. They can be picked up and moved from one substation to another. A standard seven-conductor cable connects to the three meters on one end and to a six-pole test plug on the other. Four conductors connect the ammeters to the feeder current transformers; the two conductors to a potential transformer supply power to operate the motor on the chart drive.

For power factor tests a wattmeter and watt-var autoswitch are installed in a portable, weatherproof box. Two cables connect the instruments to the test plug. Current connections are made to the wattmeter, and potential ones to the autoswitch.

Blocks Mounted in Cabinets

The test blocks are mounted inside the substation cabinets containing over-current relays. They are wired into the secondary circuits of CTs provided for relaying and to bus PTs. The CTs, usually the bushing type, are satisfactory for current or watt-var tests.

Ammeters and watt-var meter are used sequentially to test a feeder. Testing doesn't interfere with substation relaying while connections are made or the meters are running, as the relays remain in the circuit at all times.

Two systems of phase rotation at Iowa Power & Light complicated development of a uniform method of measuring system loads. Compensation for the two systems of phase rotation at the test blocks (wired into CT circuits) permits a uniform wiring arrangement on the test plug which reduces test-location set-up time.

Testers visit the various substations weekly to collect charts, service meters, and move them from feeder to feeder. About 60 feeders are being serviced with 20 sets of recording ammeters and three watt-var meters. Accordingly, each feeder is checked about every third week. The instruments are left longer than a week on such feeders as need closer attention.

(*More How To on page* 64)

Facts to file and not forget about BERMICO® electrical conduit

BERMICO
Electrical Conduit
Cellulose and high molecular strength coal tar pitch
MATERIALS
Dielectric strength
Dry ..... 48-52 kv.
Wet ..... 24-36 kv.
Electrical resistance ..... High
Fusibility, if a conductor fails ..... None
Heat resistance ..... High
Cold embrittlement ..... Low
Acid and alkali resistance ..... High
Mechanical strength
(Beam, crushing, impact) ..... Exceeds WC-581
Weight (4" diam.) ..... 2 lbs. per ft.
Abrasiveness to cable insulation ..... Nil

the conduit that gives you maximum, lasting protection with minimum cost!

Engineered to exacting standards, Bermico Conduit provides lightness, strength, and uniformity that makes it easy and fast to install. Made of cellulose fibre, impregnated with high-molecular-strength coal tar pitch with low mineral content. Bermico gives maximum protection against water. In event of cable failure, it permits easy pullout and replacement of conductors.

A hammer tap is all that's needed to make permanent, water-tight joints. Bermico comes in 8′ lengths to speed laying. Diameters are from 2″ to 6″. For economy, protection, long life, always specify Bermico Conduit. Immediate shipment of all sizes and fittings.

Distributed by WESTINGHOUSE Electric Supply Company

Offices in principal cities

BROWN COMPANY

BERLIN, N. H.

General Sales Offices: 150 Causeway Street, Boston 14, Mass.

Weights Control Insulator Swing

EARL E. CAMPBELL, Supervising Engineer, Transmission Lines, Iowa Power & Light Co, Des Moines, Iowa

Hold-down weights offer a simple and relatively inexpensive way to prevent excess insulator swinging on lines crossing rolling farm land. Weights have been applied by Iowa Power & Light on its 161-kv link between Council Bluffs and Des Moines. The extra weights should prevent excessive wear and radio interference caused by lightly-loaded insulator strings and suspension clamps. They also should foster better line performance during thunder storms, and reduce conductor galloping.

Weights installed on the 556,500-ACSR, 26/7-strand line are made of cast iron and are painted with aluminum. Two sizes were used: A 25-lb weight 1 in. thick, and a 50-lb weight 2 in. thick. Each is 11 in. in diameter. Weights were suspended from the bottoms of insulator strings, with the number and size varied to meet local conditions.

Board Facilitates Crew Dispatching

M. D. PROWSE, District Line Foreman, Appalachian Electric Power Co, Charleston, W. Va.

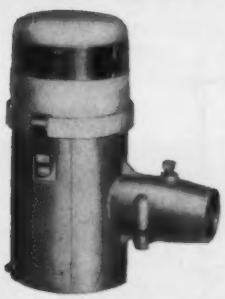
A line-crew dispatching board quickly reveals which crews are short or over in different job classifications. Names of crew members are labeled on pegs, a color code giving each man's classification.

The board, helpful at any time in making up crews, is especially useful during the vacation period. When several men in different classifications are off duty at the same time, other men must be redistributed so that each crew has a proper complement of men in each classification.

Foremen are indicated by white pegs, linemen "A" by red, linemen "B" by blue, linemen "C" by green, groundmen by yellow, and truck drivers by brown pegs. Pegging the board is the daily responsibility of the general foreman.

Wheeler Street Lighting experts put their "heads" together...

to bring you the most complete line of metal heads, including ballasts and controls to meet the requirements of every street lighting system!



Small Photo-Electric Head for EEI-NEMA Screw Neck and Groove Neck Reflectors.

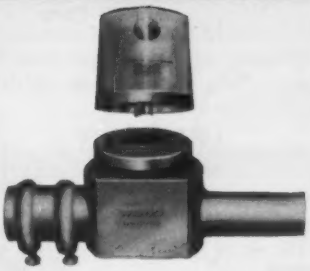


Photo-Electric Bracket Extension with Twistlock Control Receptacle. Control Shown Separately.

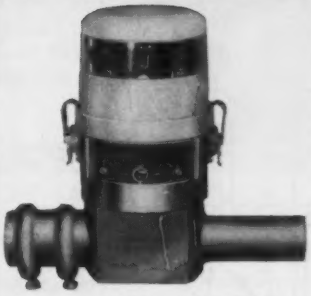
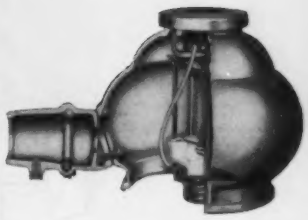
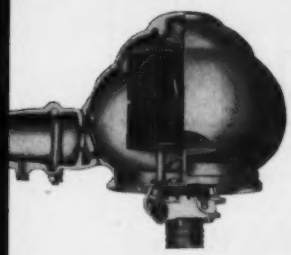


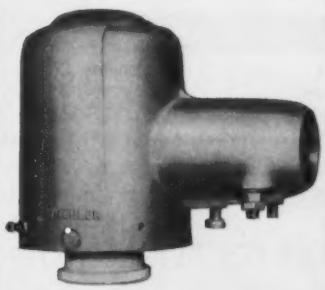
Photo-Electric Bracket Extension to add Photo Control to Existing Multiple Street Lights.



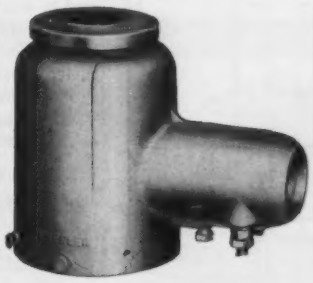
Large Multiple Head with Twistlock Control Receptacle. Cutaway View.



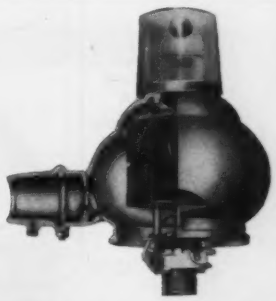
Large Multiple Head with In-Head Ballast for 100 or 175 watt Mercury Lamps.



Small Multiple Head with Foolproof Bayonet Multiple Socket for Easy Lamp Replacement.



Small Head with Twistlock Control Receptacle.



Large Multiple Head with Twistlock Control and In-Head Mercury Ballast.

Not shown but available — heads for external wiring — heads to take all makes of Twistlock controls — top mounted heads without controls.

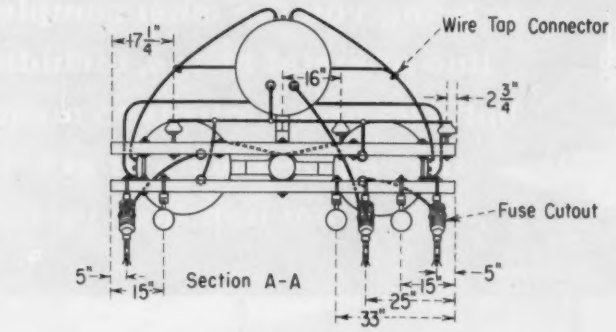
For complete details, write for new Wheeler Bulletin Section 3-7

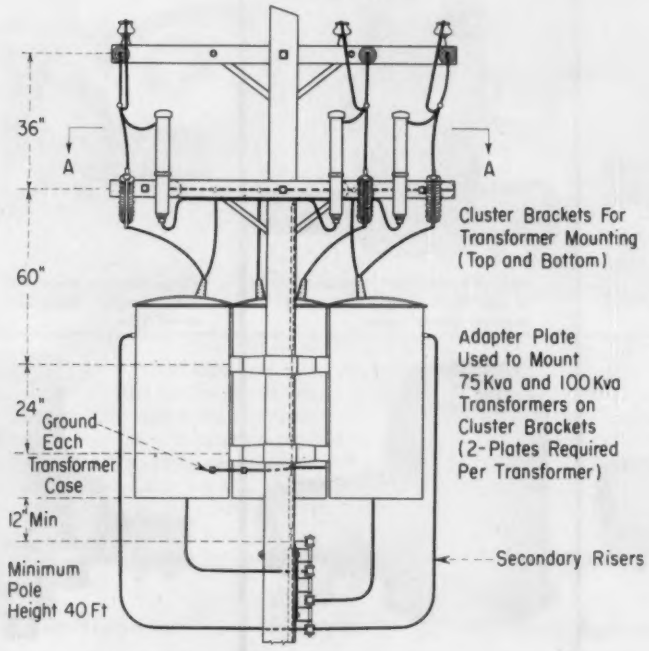
Wheeler Reflector Company (Division of Franklin Research Corp.) 275 Congress St., Boston 10, Mass.

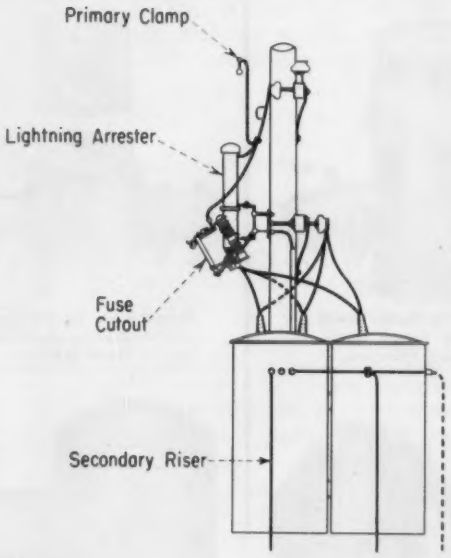
Established 1881 — our 76th year
Wheeler represents the most advanced engineering in Street Lighting

Transformer Cluster Mounted on Poles—I*

Transformers with bushings on the cover can be installed in a cluster on a pole and connected as shown in these outlines. The arrangement is designed for single-phase transformers having capacities in the range of 37.5 through 100 kva, with 4,160-v, 8,320-v or 12,470-v primaries wye-connected on 3-phase circuits and supplying 240/120-v three-phase circuits. This method is an adaptation from Distribution Specifications prepared and used by West Penn Power Co.




36"
A
A
Cluster Brackets For Transformer Mounting (Top and Bottom)
60"
Adapter Plate Used to Mount 75 Kva and 100 Kva Transformers on Cluster Brackets (2-Plates Required Per Transformer)
24"
Ground Each Transformer Case
12" Min
Minimum Pole Height 40 Ft
Secondary Risers



*Similar data for cluster mounting of transformers with side-wall bushings will be presented in a forthcoming issue of Electrical World.

Sangamo J2 Meters

CLASS 100 AND CLASS 200

Give you all the revenue you've got coming

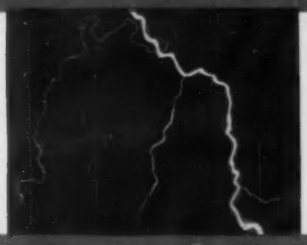
Sangamo watthour meters start on a 9 watt load and measure accurately to full 100 or 200 amperes. Will fully record the lightest loads of today and the heaviest loads of the future.

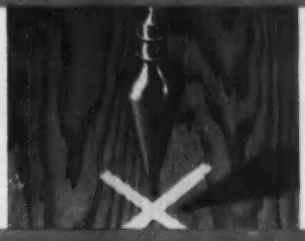
Give you all-weather accuracy

Corrosion-resistant finishes and materials are used throughout J2 Meters. You get optimum performance in humid, salt-laden or corrosive industrial atmospheres.

Give you protection against surge voltages

The extremely high insulation level of J2 Meters withstands high-voltage surges without damage. Highly surge-resistant Alnico damping magnets resist the de-magnetizing effects of lightning.





Give you sustained accuracy at all loads

Sangamo J2 Meters have the highest starting torque in the industry. Their accuracy is not affected by friction caused by foreign matter—even down to the lightest loads.

Give you slowest disk speed

Only 10 revolutions per minute at full nameplate rating means longer meter life—and pleases meter-watching customers, too!

...AND ARE GUARANTEED FOR LIFE!

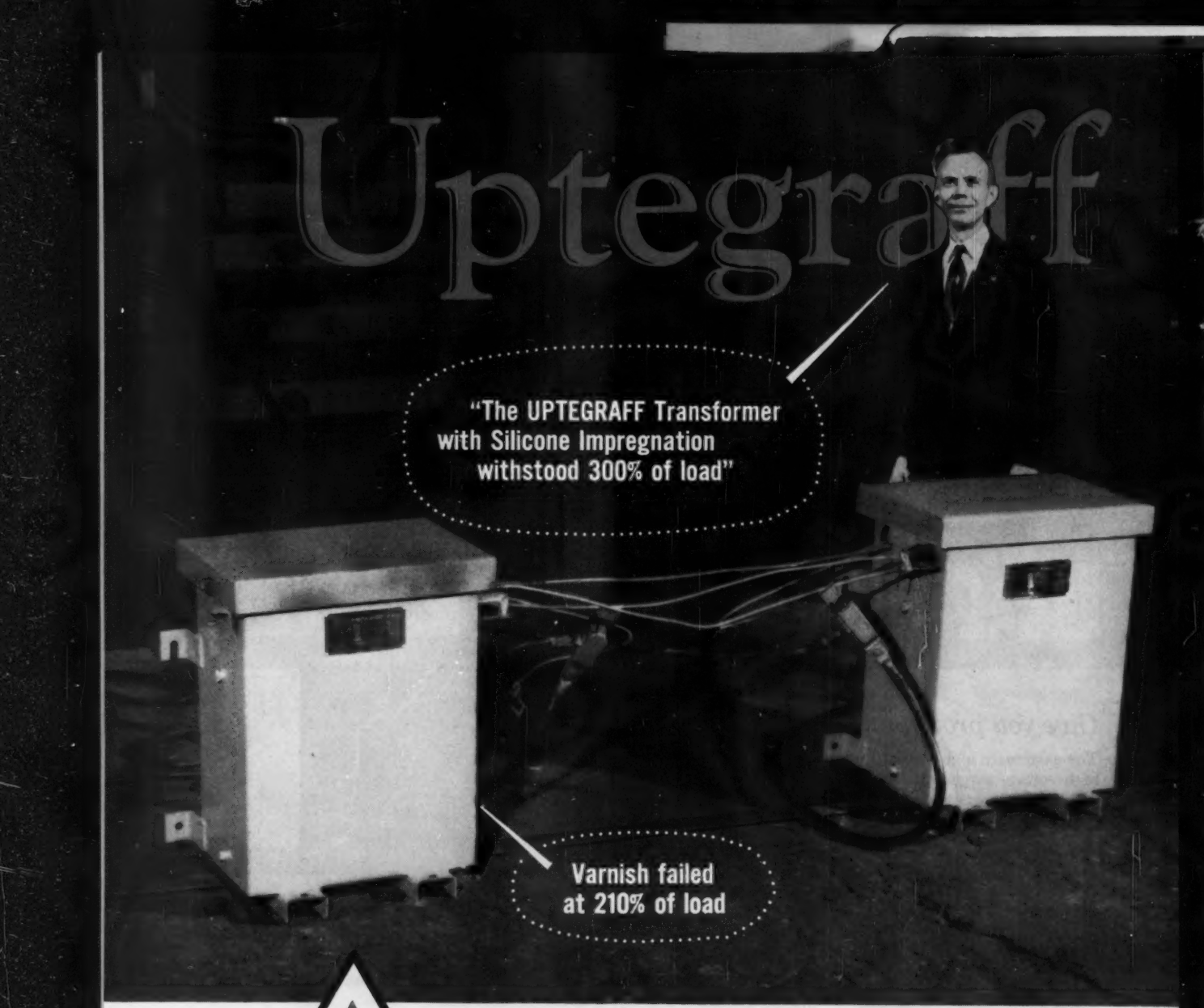
Now, an unprecedented lifetime guarantee—covering materials, workmanship and *bearing systems*—is offered on all Sangamo J2 Meters.

JM58-1

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

Uptegraff



40% Greater Overload with Silicone Impregnation

Unique Design Features of Major Models

Type H...
3-10 kva

Small, wall-mounted
Silicone impregnated, Class H insulation
Totally enclosed (dust-tight)
Accessible clamp-type terminals

Announces...

SILICONE IMPREGNATION of Class B Dry Type DISTRIBUTION TRANSFORMERS

Anticipating tomorrow's higher performance standards and increased power requirements, Uptegraff is now producing all of its Class B Dry Type Distribution Transformers, 112½ kva and smaller, with Silicone-impregnated windings.

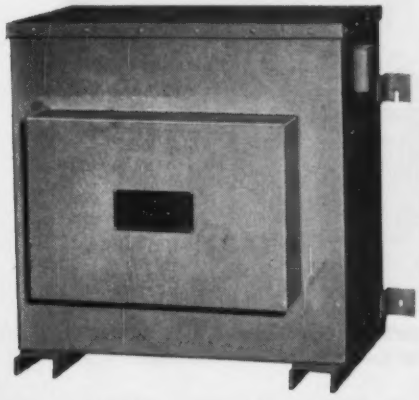
Overload tests—after extensive research in insulating materials—conclusively prove that transformers with Silicone Impregnation withstand up to 40% greater overload than ordinary varnish, and provide superior moisture resistance and freedom from embrittlement and cracking with age. Organic varnish used by most manufacturers for Class B 80°C transformers degenerates with time and has less thermal stability, while the inorganic Silicone type insulation provides much higher temperature-resisting characteristics.

In the comparative test seen on the left, transformers rated for Class B 80°C temperature rise were started with a full rated load. This load was increased by 20% increments and each increment was held until the temperature remained steady. The varnish failed at 210% of rated load while the Silicone-impregnated insulation withstood 300%.

New Bulletin Gives Complete Details...

Bulletin 137 provides additional advanced design features of Uptegraff dry type distribution transformers, 3 kva to 500 kva inclusive, 4800 volts and less. Write for your copy *today*.

R. E. UPTEGRAFF MANUFACTURING COMPANY
SCOTTDALE, PENNSYLVANIA

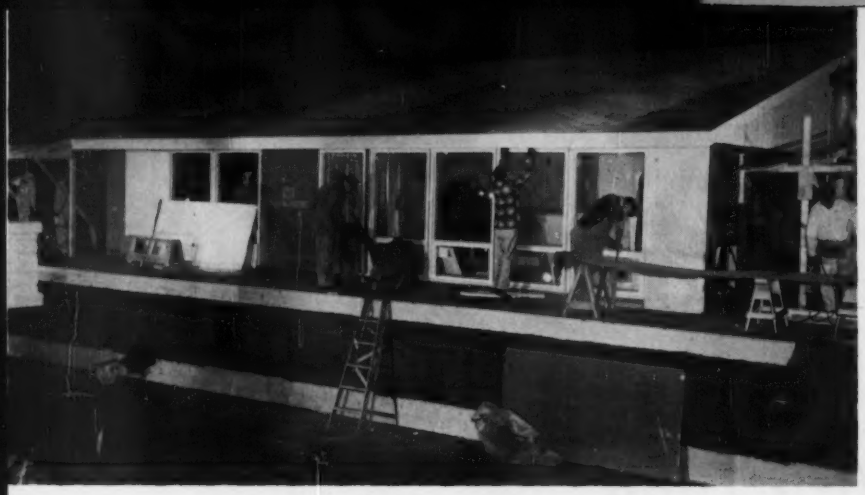


Type DH & DHT ...15-112½ kva

Junction box for leads and taps
Silicone impregnated, Class H insulation
Totally enclosed (suitable for outdoors)
Flexibility as to mounting
Low sound level

Type DB & DBT ...3-112½ kva

Silicone impregnated, Class B insulation
Ceiling, wall or floor mounting
Metal and porcelain terminal boards
High voltage and low voltage separated on voltages over 600



1958 Appliance Doors to Public

January in Chicago is one long series of conventions, meetings, and shows. The air in the Windy City is punctuated with new claims about new models to fill new unlimited horizons. This January was no exception. Nor were the 1958 Home Furnishings and Appliance Shows held at the Merchandise Mart.

Big feature this year was the six-room Gold Medallion Home (shown being built at upper left), a duplicate of which is to be given away with a corner lot in a Chicago suburb. The reason behind the house: To bring consumers to the show, open this year to the public for the first time, and to "pre-sell" them for manufacturers and dealers. The cost of the house and other appliance displays and promotions, split down the middle by Commonwealth Edison Co and the Merchandise Mart, ran a rumored $100,000.

How did it pay off? Commonwealth Ed hoped to get 100,000 people through the house and show at 90¢ a head in 10 days to cover costs. What they got the first day surprised them: 75,000 people and an early closing for safety's sake. The utility estimate 183,057 had visited when the show opened Jan. 25. This attendance, Commonwealth Ed advises, was cut 'way down by several days of bad weather. If weather had been good, something between 200,000 and 300,000 people might have showed up. The response made both the utility and the Merchandise Mart enthusiastic enough to begin planning the '59 show right away.

The Gold Medallion awarded the home specifies three important electrical features: Year round electric heating and air conditioning; lighting in accordance with utility or AHLI standards; and at least three major electric appliances, not counting an electric range (EW, Oct. 28, 1957, p 47). It differs from the ordinary Bronze Medallion principally in that it has electric heating and air conditioning.

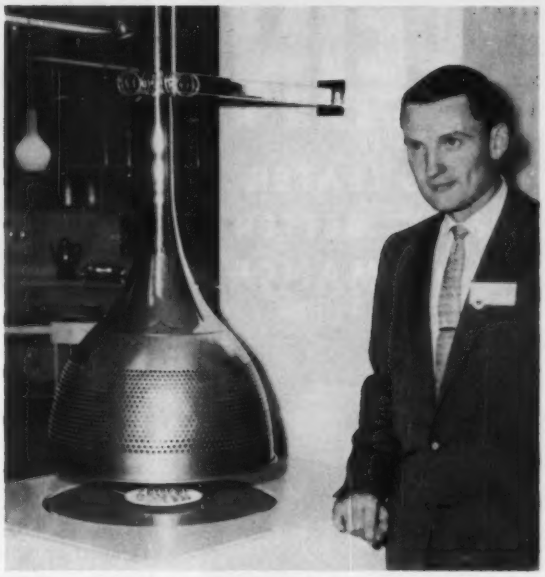
Although the all-electric home was the big attraction, it was by no means the only one. Thousands hypnotically watched demonstrations and exhibits of gadgets that ran the gamut from electric vibrating beds to radio-controlled ovens to detergent-dispensing electric water heaters.

One thing stood out big and clear against the gleaming white and chrome: The trend to automation is in the home as well as the factory. Every control, every innovation is aimed at taking more work away from the housewife, making her life more automatic and theoretically liesurely.

CUSTOM BUILT RANGE, infinitely more complex than Grandma's stove, is explained by Hotpoint's Sally O'Neill

RADIO-CONTROLLED OVEN is demonstrated by E. D. Kenna of Westinghouse. Note the retractable-antenna unit

and Home Show Opens for First Time in History



UNIQUE ELECTRONIC COOKER by Westinghouse has a hood that raises to receive food, lowers to cook it in seconds

And if the market psychologists—the "depth probers"—decry the trend, the manufacturers think they're on solid ground. Listen:

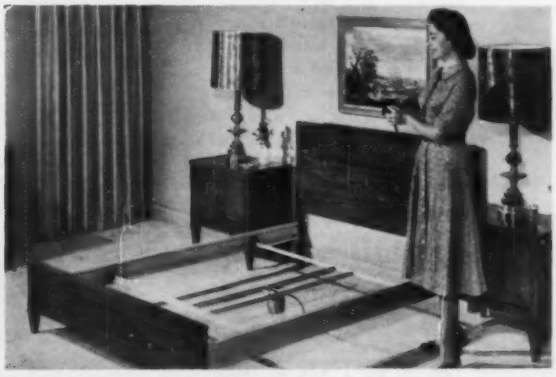
Judson Sayre, Norge president: "More appliance business will have to come from building new features into appliances and selling customers on paying the difference for them."

Max Fuller of Maytag emphasized his company does not bring out new models annually, but only when they have some new features to offer . . . all directed toward making home laundering easier.

Some of the interesting, look-into-the future exhibits at the show are displayed on these pages. These make up a sample—by no means all—of the displays that went to make what one industry spokesman called, "the most successful electrical appliance and housewares promotion the industry has ever had."

SWING-OUT SHELVES in refrigerator is example of features Norge feels will help the appliance industry

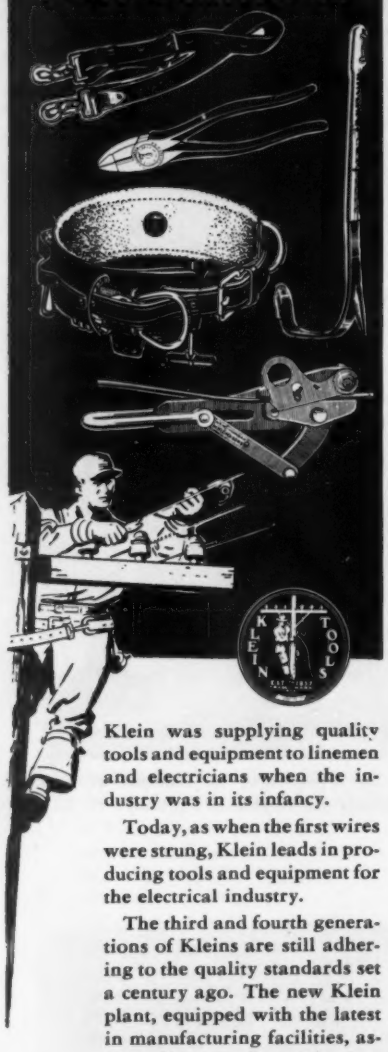
'LIGHT CONDITIONED' LIVING ROOM in Gold Medallion Home integrated lighting with other interior decoration



ELECTRIC VIBRATING BED, built by Englander, was a crowd puller. Unit is low power, offers nice off-peak load

KLEIN

FOR GREATER SAFETY, BETTER PERFORMANCE



Klein was supplying quality tools and equipment to linemen and electricians when the industry was in its infancy.

Today, as when the first wires were strung, Klein leads in producing tools and equipment for the electrical industry.

The third and fourth generations of Kleins are still adhering to the quality standards set a century ago. The new Klein plant, equipped with the latest in manufacturing facilities, assures better, safer equipment, wherever power lines or communication lines are strung.

100 years of service to linemen, electricians and industry is back of this new Pocket Tool Guide No. 100. A copy will be sent to you on request, without obligation.

Mathias Established 1857 KLEIN & Sons Chicago, Ill. U.S.A.

7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

McGRATH KREISER MILLER ARONSON

NAHB Gets Electric Heat Pitch

Electric heating was given a big boost to home builders recently. Teamed up with "Live Better Electrically", electric heating participated in a program entitled "New Ways the Electrical Industry Can Help Builders," at the National Association of Home Builders Convention in Chicago.

Outlines Advantages to Builders

Lead-off man in the electric heating line-up was Wiegand's C. F. Krieser, acting in his capacity as chairman of NEMA's Electric House Heating Committee. Beginning with a few background remarks on the growth of electric heating and some of the reasons for it, Kreiser went on to outline its advantages for builders:

- Savings in initial cost.
- Greater cleanliness, comfort and convenience.
- Modernity—a selling feature.
- Kreiser went on to advise builders to ask help from local utilities: "Invite the assistance of your local utility as your sales allies. Today we find more utilities than ever enthusiastically endorsing the march of electric heating progress."

Berko sales manager S. B. Aronson, also a NEMA committee member, backed up Kreiser on the pitch to builders. Going to bat on a "why-the-homeowner-likes-electric-heating" play, Aronson promptly hit away at these points:

- Versatility of equipment.
- Zone control.
- Space savings.

Aronson drove this last point home with: "Electric heating can be controlled within ½ of a degree of desired temperature, and it reacts immediately. There is no lag. Add to this a lack of drafts prevalent in so many homes today."

Clean-up man in the line up was Carrier Corp's W. L. McGrath, talking about heat pumps. From the outset, McGrath made the point was that ". . . a heat pump is not a competitive heating plant *per se* because of first-cost disadvantage . . . unless summer cooling is accepted as a necessity." Talking the builder's language, McGrath cited the recent FHA ruling that field offices should encourage inclusion of air conditioning in mortgages (EW, Jan. 13, 1958, p49).

Heat Pump to Dominate Future

McGrath told the builders that there were reasons to believe the heat pump will become a predominant method of heating. Among them: Air conditioning is here to stay; the trend toward using the same form of energy for both heating and cooling; an effort to use the most efficient heating and cooling plants because of increasing future demands on our energy sources.

But the builders played the game too. NAHB Treasurer Martin Bartling, scheduled to give "A Builders View of Electric Heating", was unable to speak because of an illness. NEMA Electric Heating Secretary Myron Miller, delivering Bartling's pitch, said, "We think that electric heat is a buyer's natural. It is something they like and want . . . If you sell its advantages, the advantages will sell the electric heat."

(*More Selling on page* 74)

AN IDEA PIONEERED BY

DUNCAN

Duncan pioneered the Class 200 rating with the "Extended Range" Type MF-SE meter introduced eight years ago. This "50 amp" singlephase meter provided capacity to 200 amps. Within two years, Duncan also made 200 amp "extended range" capacity available in the Type MH polyphase meter.

TYPE MF-SE (1949)

CLASS 200 RATINGS *for More "Housepower!"*

30 AMP.

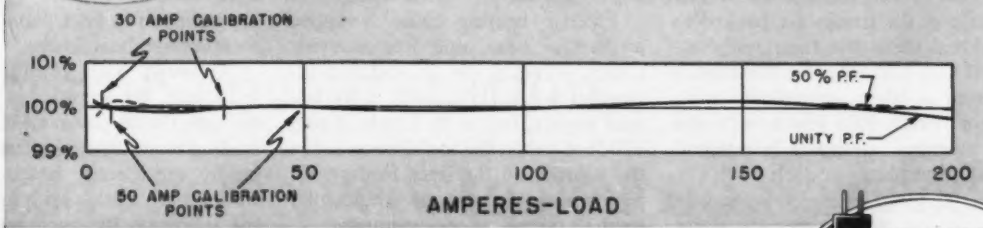
50 AMP.

TYPE MK

The Duncan Type MK Class 200 meter is the latest of the improved singlephase MK line, built to accurately meter a wide range of loads from a few watts to the meter's full 200 ampere capacity. Arc-resistant insulation in the electromagnet, self-contained arc gaps to by-pass electrical disturbances, and Alnico V permanent magnets to maintain calibration stability are just a few of the MK features in this meter.

This meter also offers excellent performance. Note the "straight line" load curves in diagram below. Meters are available with test ampere ratings of both 30 and 50 amperes, starting watts 24 and 36, respectively.

Duncan offers "Meters to Meet Your Requirements", with field engineers and representatives serving all areas of the country. Quick delivery from finished stocks. TRY DUNCAN SERVICE!

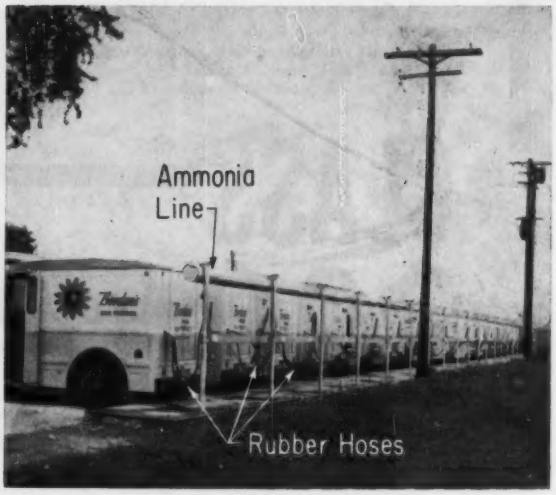


DUNCAN ELECTRIC CO., INC., LAFAYETTE, INDIANA

NATIONAL ELECTRICAL WEEK

FEB. 9-15, 1958

With heat bulbs for winter . . .



and circulating ammonia for summer . . .

Dairy Trucks Get "Air-Conditioned" Parking Lot

W. L. STREICH, Commercial Sales Representative, Wisconsin Electric Power Co, Milwaukee, Wis.

Winter or summer, the modern heating and cooling equipment installed in the delivery trucks of one Milwaukee dairy assures prompt daily delivery of quality products. The heating equipment keeps the products from freezing and eliminates motor stalling in the winter. In summer, the cooling system inside the truck helps keep the product fresh until delivered.

Each truck at the Layton Avenue branch of Borden Dairy Co has two permanently installed ammonia plates for cooling the interior. When not in use, the trucks are parked in individual stalls at a ramp and connected with portable, flexible rubber hoses to a 40-hp central air compressor. From 3:00 PM to 4:00 the next morning, ammonia is pumped through the plates in each truck.

By bringing truck temperature down as low as possible, the dairy products stay cold until delivered. The ramp can accommodate 35 trucks, with individual cooling connections and a portable electric power cord for each.

During the winter, the engine block of each truck is fitted with a head-bolt heater. The driver connects the heater on his truck to the ramp power line after parking. Heaters are turned on by the night supervisor to allow the block to warm up by the time the trucks are ready to start. Turn-on schedule depends on the outside temperature. With this system, it is expected that truck stalling in cold weather will be completely eliminated.

In addition, the interior of each truck is equipped with two sockets for 100-w heat lamps. Also controlled by the night supervisor, these are used in the winter to keep the dairy products in the truck from freezing.

The results of the installations have been very satisfactory. Systems similar to this are being planned for three other Borden Dairy outlets in the Milwaukee area.

Cable Ends Sugar Plant Slowdown

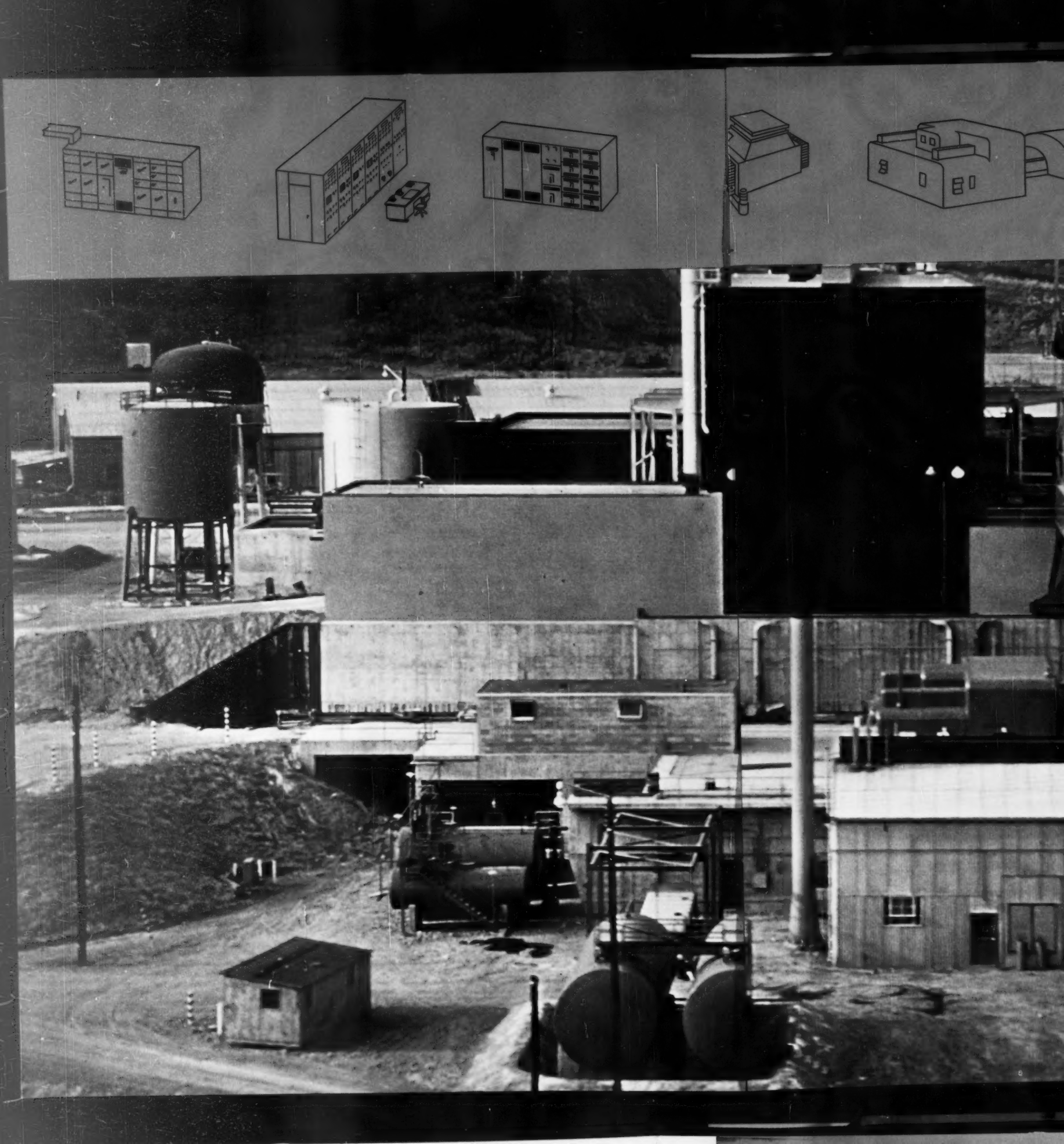
Electric heating cable, wrapped around a 2-in. pipe line carrying caustic solution, put an end to cold-weather work slowdowns at Industrial Sugars, Inc, in St. Louis. Using 120 ft of cable, the installation keeps the solution in the lines feeding the pump and the process sufficiently fluid to permit proper pumping.

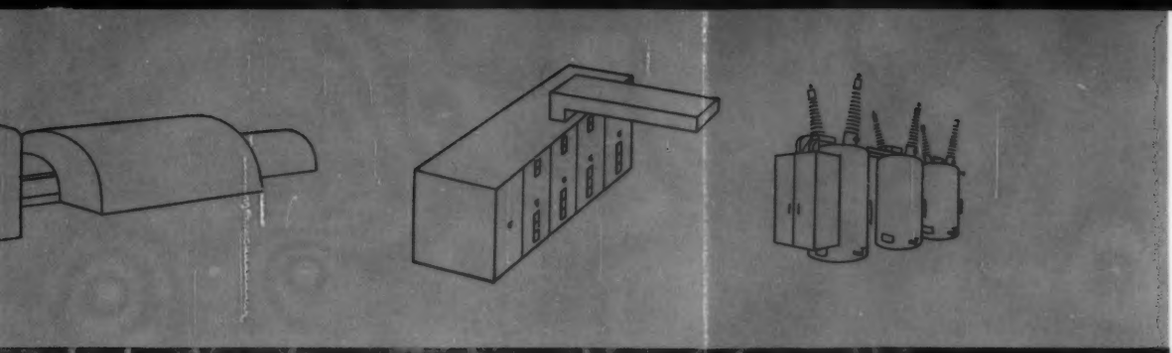
The installation is supplied at 220 v ac and is rated 800 w. A thermostat provides adequate temperature regulation. Both piping and cable are wrapped in fiber glass insulation to minimize heat losses.

Although the 10,000-gal tank in which the caustic is stored is equipped with steam coils, the lines leading from the tank often froze up before the electric heating was installed. An earlier attempt to beat the freeze-up by tracing the piping with copper tubing steam lines failed to eliminate difficulties on Monday mornings after the long weekend shutdown.

SHIPPINGPORT, U.S.A.

World's first full-scale
atomic power station
devoted exclusively to peacetime needs





Westinghouse atomic reactor pours power into Pittsburgh area–industry, commerce, homes

One of the most important pieces of machinery in the history of American industry officially went on the line December 18, 1957, when the world's first full-scale atomic power reactor devoted exclusively to peacetime needs started to produce power at Shippingport, Pa.

Out of that generating station is coming the first large-scale production of electricity from the atom . . . but out of it also will come the answers to questions which are of the utmost importance to the electric utility industry.

For the answers to these and dozens of other questions, scientists, engineers, businessmen, utility executives and Government officials have been and will be intently watching the Shippingport reactor.

The development of the full potential of atomic energy as a source of electricity has been . . . and still is . . . a job of gigantic proportions, and that gives this pioneer plant an importance far beyond any foreseeable advances in the conventional power plant.

Westinghouse is proud to have played such an important part with the U. S. Atomic Energy Commission and Duquesne Light Company in this historic development.

The Shippingport plant is a joint venture of the Atomic Energy Commission and Duquesne Light Company. Westinghouse, under contract to the A.E.C., designed and developed the nuclear reactor. Duquesne Light built the electric generating portion of the plant and is operating the entire plant.

YOU CAN BE SURE...IF IT'S Westinghouse

CONGRATULATIONS TO DUQUESNE LIGHT COMPANY, PITTSBURGH, PA., on the starting of the world's first full-scale nuclear power generating station devoted exclusively to peacetime needs

At Shippingport, Pennsylvania, this joint project of the U. S. Atomic Energy Commission and the Duquesne Light Company is the world's first full-scale atomic power station devoted to nuclear power exclusively for civilian needs. Shippingport will be operated by the Duquesne Light Company.

Westinghouse designs, develops, coordinates, builds nuclear reactor and associated equipment

The Shippingport plant is the result of research, hard work and cooperation. Westinghouse designed and developed the nuclear reactor under contract to the Atomic Energy Commission, while Duquesne Light built the electric generating portion of the plant and is operating the entire plant.

FROM WESTINGHOUSE RESEARCH, ENGINEERING AND MANUFACTURING RESOURCES COMES EQUIPMENT FOR THE ATOMIC ELECTRIC POWER PLANT

In addition to the nuclear portion of Shippingport, Westinghouse supplied . . .

Turbine Generator
Power Breakers
Control Centers
Instruments
Condenser and Condensate Pumps
Metal-Clad Switchgear
Dry-Type Transformers
Protective Relays

from plowback of earnings into research and development

Westinghouse, leader in research and development of power apparatus for over 70 years, can provide you with a two-pronged advantage in the nuclear power field—Westinghouse research, engineering and manufacturing facilities for a complete line of power plant apparatus—and the longest record in successful atomic power development.

Westinghouse entered the nuclear field over 18 years ago with the first industrial atom smasher. To maintain this leadership, Westinghouse is currently building the first privately owned materials testing reactor. This is another step in the continuing program of development and testing of nuclear control and power generating apparatus. Today's most complete facilities are backed by years of laboratory and practical experience unexcelled in the industry.

YOU CAN BE SURE...IF IT'S Westinghouse

Section of the co
the world's first
voted exclusively

THESE CONTROLS CHANI NATURE'S BASIC FORCE INTO 60,000 kw OF COMM

Over-all coordinated operations center pro complete nuclear plant control and instru first full-scale atomic power plant

At Shippingport, Pennsylvania, one control room provides for the operation and control of the nuclear reactor, its associated equipment and the turbine generator. The electrical systems required for the control and instrumentation of the plant are designed into functional groupings in this key center.

The
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panels l

BUY EXPERIENCE . . . BUY WESTINGHO

Under contracts from a number of the world's leading electric utilities, Westinghouse is continuing the development of the full potential of atomic energy as a source of electric power. Outstanding among the domestic projects are:

Penns

A partn
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type of

Yankee Atomic Electric Company

A 134-mw plant being built near Rowe, Massachusetts, by 11 of New England's leading utilities. Scheduled to go on-line in 1960, this plant features a pressurized water reactor with stainless-steel-clad fuel elements. In addition to the nuclear steam generator, Westinghouse is supplying other major components for the plant.

Westing
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YOU CAN BE SURE.

of the control and instrumentation center of
ld's first full-scale atomic power station, de-
clusively to peacetime needs, Shippingport, Pa.

ANNEL
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OMMERCIAL POWER

r provides
nstrumentation for the world's

The control and instrumentation devices are grouped in panels with their corresponding switches, meters, instruments and other operators' controls on the console panels. All functions are monitored at their respective console panels by the operators.

NGHOUSE

Pennsylvania Power and Light Company

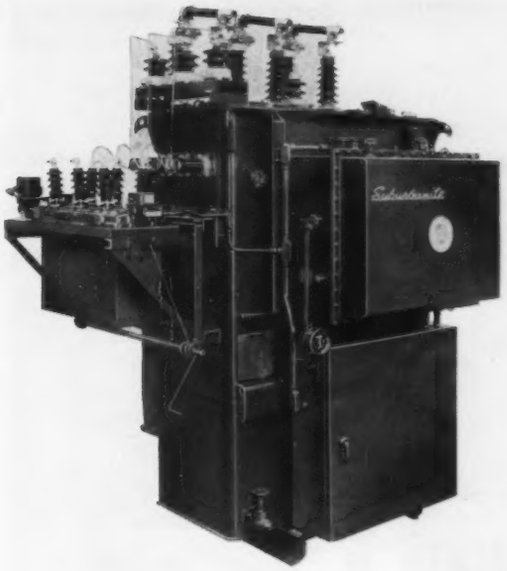
A partner with Westinghouse in the design study of a large aqueous homogeneous reactor. This type of reactor anticipates a low fuel cost.

Westinghouse has pioneered many important generating station developments and pioneered, too, atomic power development. Westinghouse is equipped by experience in design and manufacture to consult with you and to provide the best in power stations, nuclear or conventional.

CP-1049

E SURE...IF IT'S Westinghouse

New Equipment

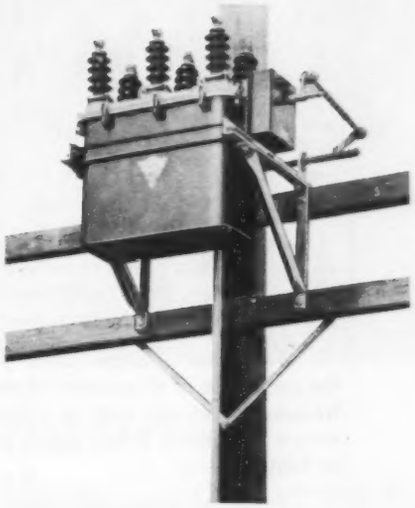


Integrated Substation . . .

. . . with automatic recloser is designed for rural areas, small towns, and outlying industrial plants. It includes metering devices, high and low voltage arresters, high voltage fuses, and low voltage load tap changer. Used with pole-mounted disconnects, it forms complete substation with minimum of installed equipment.

Recommended for applications through 2.5 Mva, Suburbanite may be used for higher ratings within recloser capacity. High voltage range is 15 to 69 kv; low voltage, 2.4 through 15 kv. Either one or two circuits may be provided.

Pennsylvania Transformer Div, McGraw-Edison Co, Canonsburg, Pa.



Oil Switches . . .

. . . interrupt 400 amp lagging current at all pf down to 10%. An addition to Type V, 3-phase outdoor line, they have 110-kv BIL and can be used for phase-to-phase ratings up to 14.4 kv. Momentary latching rating is 20,000 amp asymmetrical; four-sec rating, 6,000 amp symmetrical.

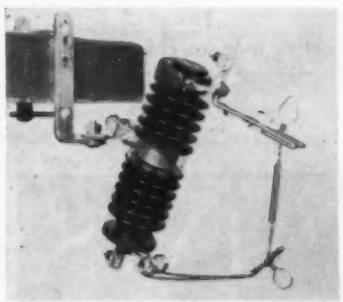
Model VLH is hookstick operated; VLR is motor operated; VLM has manual-remote handle. Bayonet contact assures long, trouble-free life. Accessories include heating elements, low-voltage signal arresters, mounting assemblies for poles or substations.

Line Material Industries, Milwaukee 1, Wis.

Remote Control Switches . . .

. . . for locations where quiet is essential have vibration mounts and soundproof enclosure. Switch operating noise is only faintly audible at 3-ft distance. Switch is available, open or enclosed, in two and three-pole models, with ratings up to 200 amp at 600 v ac and 75 amp at 250 v dc. These mechanically held units are unaffected by line voltage condition, respond only to push-button action. Publication No. 627 has complete data.

Automatic Switch Co, Florham Park, N. J.



Flip-Open Cutout . . .

. . . is redesigned with bronze parts for better corrosion resistance. Metal parts are now clamped instead of cemented to porcelain insulator. Tin-plated Strenicor eyebolt connectors accommodate either aluminum or copper conductors in sizes from No. 8 solid to No. 2 stranded.

Ratings of 7.8 and 15 kv are available for individual crossarm mounting; 7.8 kv only for unit combination or bushing mounting applications. Model shown is 50 amp, 7.8-kv unit.

General Electric Co, Schenectady 5, N. Y.

(*More New Equipment on page* 82)

SAVE 1 OR 2 COATS OF PAINT ON YOUR NEW PLANT

Start your new plant with Subox protection and save from the very beginning.

As the only American paints made with lead-suboxide, Subox paints provide extraordinary anti-corrosion protection. Lead-suboxide is *chemically active:* Actually works to prevent corrosion.

Two coats of Subox paint generally will give the protection of three coats of standard paint and frequently but one coat is sufficient. Even under severe conditions, Subox paints do not crack, chip or blister.

Eventual repainting costs are minimized because lead-suboxide establishes a dense, metallic lead film which can be recoated without expensive surface preparation.

Available in many attractive modern colors. Write for brochure: *"Plan Painting of New Plants to Reduce Costs".*

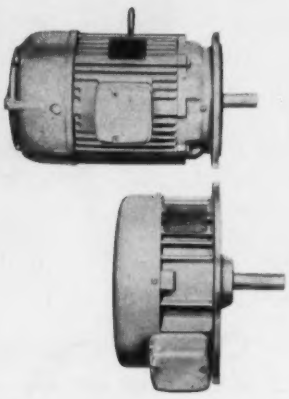
SUBOX PAINTS

Subox Inc.
*Trade Mark

Established 1924
3 Fairmount Plant
Hackensack, N. J.

Backfeed Checker . . .

. . . is also used in locating grounds, open cables, and other troubles. Neon lamp flashes on voltages as low as 80 v. Rate of flash increases with voltage; at maximum rating, light is continuous. The interior of the tube is darkened to make flash more visible. Standard model is rated from 80 to 5,000 v; other models are available for up to 25 kv.
HD Electric Co, Deerfield, Ill.



Pancake Motor . . .

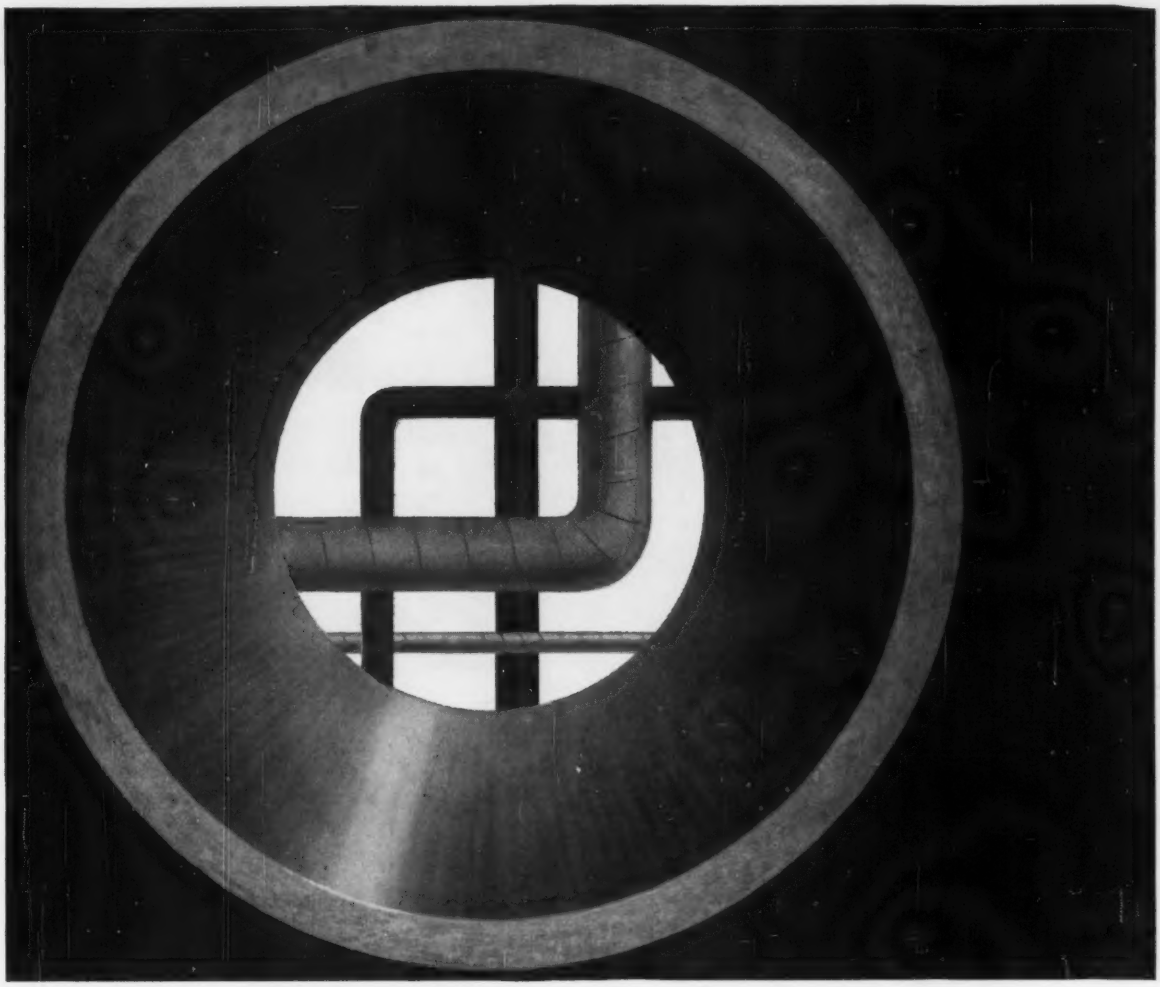
. . . cuts motor length up to 60% on machine tools, roof-ventilating fans, and other cramped space applications. Reduction is achieved through formed end coils and one-piece cast iron housing-bearing bracket, without any loss in performance. Flange-type motor has radial air-gap design.

Ratings range from 1 to 15 hp at 900, 1,200, and 1,800 rpm. Features include vertical or horizontal mounting, and factory lubricated bearings. Bulletin 2100 describes enclosed model; Bulletin 2150 the open, drip-proof motor.
Louis Allis Co, Dept P, 427 E Stewart St, Milwaukee 1, Wis.

Closed Circuit TV . . .

. . . permits remote control of focus and iris, vertical and horizontal movement, and lens selection. Camera of Vidcon Mark IV has rotating turret with three interchangeable lenses. System includes camera,

(*Continued on page* 84)



Enjay Butyl—*today's super-rubber*

improves pipeline protection...cuts costs!

Plicoflex® Tape Coating, revolutionary new pipeline wrapping developed by Plicoflex, Inc., combines the outstanding protective properties of Enjay Butyl Rubber with the identification properties of a color-bearing plastic film to which the Butyl is laminated. Applied over an Enjay Butyl based primer and forming a permanent bond to the metal, the tape features: absolutely *no* moisture migration or penetration; exceptional resistance to shock-impact; excellent dielectric properties, and outstanding resistance to normal and unusual corrosive influences. This *cold-applied* wrapping is *safer* and *cheaper* to apply by hand or machine than hot coatings and requires fewer personnel.

This is still another in the steadily growing number of products developed with Enjay Butyl Rubber. Contact the Enjay Company for complete information about this truly *wonder* rubber . . . where it can help *you!* Complete laboratory facilities, fully staffed by trained technicians, are at your service.

ENJAY BUTYL

Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

ENJAY *Pioneer in Petrochemicals*

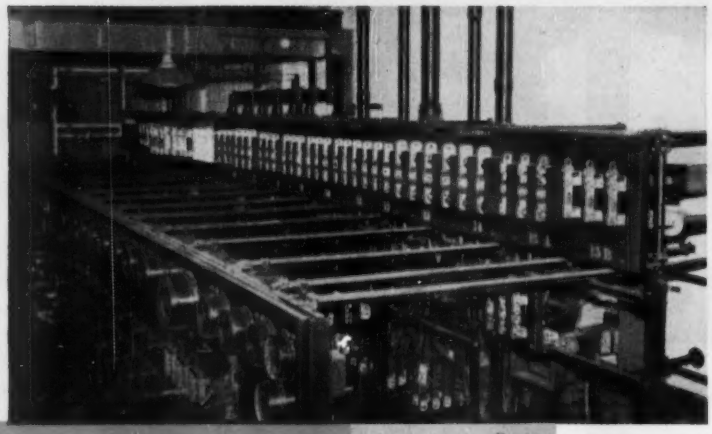
ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.

Akron • Boston • Chicago • Detroit • Los Angeles • New Orleans • Tulsa

Anticipate* Destruction

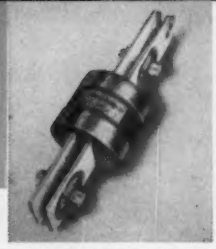
Amp-trap PREVENTS DEVELOPMENT OF HEAVY SHORT CIRCUIT CURRENTS

* To preclude or prevent by prior action — " Webster



SHAWMUT Amp-trap*

"T. M. REG. U. S. PAT. OFFICE"



Amp-trap installation at Bird & Son, E. Walpole, Mass., raised the interrupting capacity of the system from 20,000 amperes to 100,000 amperes R.M.S. at 600 Volts, 60 Cycles.

NEW, LOW-COST SHORT CIRCUIT PROTECTION

Amp-trap, with its 100,000 RMS Interrupting Capacity, opens the circuit so fast that it *precludes* the development of the peak available short circuit current. Consequently, it *prevents* both magnetic and thermal destruction. Even phase-to-ground faults are cleared so quickly that multi-conductor faults are usually avoided.

CERTIFIED AND APPROVED

Amp-trap is listed by Underwriters Laboratories. Interrupting tests up to 202,000 amps at 500v 60 cycles have been witnessed and certified by Electrical Testing Laboratories, Inc. Amp-trap is favored by many insurance companies.

FOR SYSTEMS OLD OR NEW

Amp-trap is supplied in all standard ratings up to 4000 amperes for application on any circuit up to 600 volts AC or DC. It can be used on either old or new switchgear with a minimum of structural rearrangement. "Outage" time for installation is negligible. There is no better way to insure your investment in switchgear, buss-ducts, motor starters, circuit breakers and current transformers. Every service entrance on a network system needs Amp-trap protection. The list of Amp-trap users reads like the Blue Book of American industry. Investigate now.

"You Can Get Amp-traps"

WRITE FOR FREE AMP-TRAP BULLETIN TODAY

REGISTERED UNITED STATES PATENT OFFICE Est. 1893

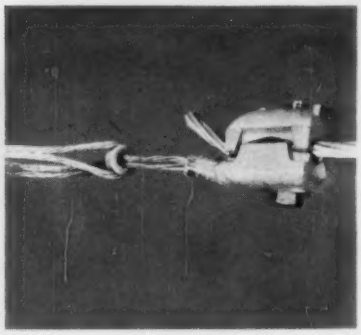
AMP-TRAPS — *Awake At The Switch*

THE CHASE-SHAWMUT CO.

374 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

Amp-trap Trion td C-Q-T Trionic Q-T FUSE WIRE

control unit, monitors, and accessories. Modular construction of control unit reduces downtime and maintenance. Where remote control is not required, manually controlled Mark III camera with single lens can be used.
Insul-8-Corp, 1369 Industrial Rd, San Carlos, Cal.



Bolted Dead-End Clamp . . .

. . . for light-duty pole and house service drops has one-piece design for fast, simple installation. Clamp body has wave seat to increase holding power. Coded DGD, it fits cable sizes from No. 8 to 1/0 ACSR.
Anderson Electric Co, Box 2151, Birmingham 1, Ala.

Transformer . . .

. . . for H-1 400-w mercury lamp is weather-proof, watertight. It has ±1% power regulation for line voltage swings up to ± 13%. Peak/rms ratio is less than 1.7, assuring long life and good lumen maintenance in vertical or horizontal position. Open circuit voltage over entire range is 300 v min. Positive starting is assured down to —30F. Unit is 20% lighter and 25% smaller than previous models.
Sola Electric Co, 4633 W. 16th St, Chicago 50, Ill.

Cartridge Heater . . .

. . . with 0.25-in. diam permits close thermal control in restricted areas such as dies and platens. Moisture

(*Continued on page* 86)

All 4 offer more light—save more money because Sylvania puts the reflector inside

Regardless of your lighting requirements —there's a Sylvania reflector lamp that can help reduce your lighting costs.

Sylvania reflector lamps give you more usable light without increasing power costs. You eliminate frequent, costly reflector and fixture cleaning expense. You get a higher degree of efficiency because light-dimming dirt, dust and grime can't affect the sealed-in reflector.

Sylvania reflector lamps are available in all 3 major lamp types:

Mercury Vapor (KS-HI) — a highly efficient 400 w. Silver-White lamp that combines the advantages of an internal reflector lamp with the economies of mercury vapor lighting. Its 23,000 lumens represent an important increase of over 20% in light output compared to other types of mercury vapor lamps of the same wattage.

Fluorescent—You get up to 60% more directed, usable light with Sylvania's Reflector Fluorescent Lamp. Available in single-pin and bi-pin types, they are made in a broad range of colors and sizes. They are particularly suited for industrial lighting, for bare-lamp strip lighting, and directed light in store windows, coves, valances, etc.

Incandescent — Sylvania Incandescent Reflector and Projector Lamps are available in "spot" and "flood" types. "Spots" concentrate a beam of high intensity, while "floods" give a wider, more diffused beam. Reflector lamps are suitable for high-bay industrial lighting, and close visual assembly work, parking areas, etc. Projector lamps are better for area floodlighting and general outdoor applications, or for interior industrial auxiliary lighting and many commercial applications.

Let your Sylvania Supplier demonstrate the dollars-and-cents advantages of high-efficiency reflector lamp lighting. Call him today, or write for information to:

SYLVANIA ELECTRIC PRODUCTS INC.
Lighting Division, Dept. 8L-7602
60 Boston Street, Salem, Mass.
In Canada: Sylvania Electric (Canada) Ltd.
Shell Tower Building, Montreal

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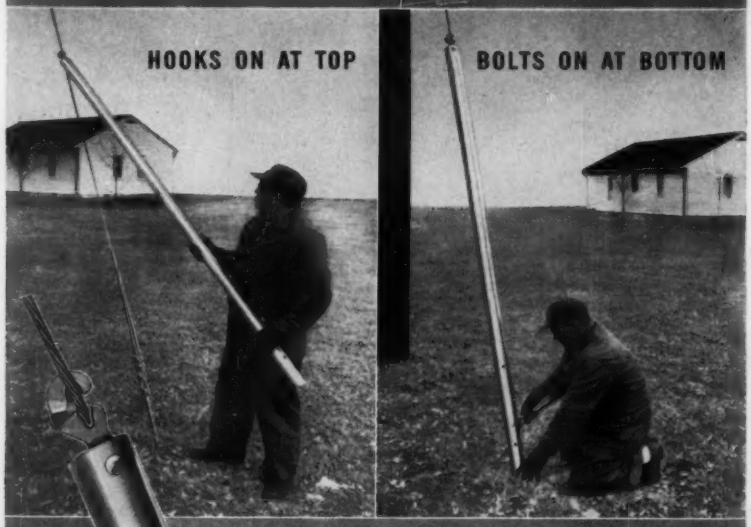
Question: What makes the CHANCE 808 GUY GUARD the groundman's preference?



Answer: Ease of Installation!

Guy Guards that are easy to install are easy to get installed where and how you want them. The Chance 808 is an inexpensive guy guard designed for fast, easy installation. Even a midget can install it—there are no high bolts to fasten at the top—only one bolt at the bottom.

The 808 hooks easily around the guy wire at the top. The hook binds to hold tight when bottom of guard is brought into position. Hook holds guard away from wire to eliminate noisy vibration. Flanged edges of hook prevent strand cutting, and help to keep guard in position.

Single bolt at lower end of guard fastens to guy rod . . . or to guy wire . . . or to guy loop. You get proper installation every time.

Economical too!

The Chance 808 is economical in first cost . . . in labor costs . . . and in service. It is made of heavy gauge steel, hot dip galvanized for long life and high visibility. Edges are turned in for extra safety and rigidity.

Get the Chance 808 from your Line Equipment Wholesaler. Your groundmen will like its features . . . and you'll like the savings.

A·B·CHANCE CO.
CENTRALIA, MISSOURI
(A. B. Chance Co. of Canada, Ltd., Toronto)

CP58-4

resistant unit has stainless steel sheath, produces surface temperatures up to 1,250 F. Models are available in any length from 1-in. up and with any specified voltage. Standard lead length is 10 in., with other lengths available.
Hotwatt Inc, 16 Gould St, Danvers, Mass.

Prismatic Light . . .

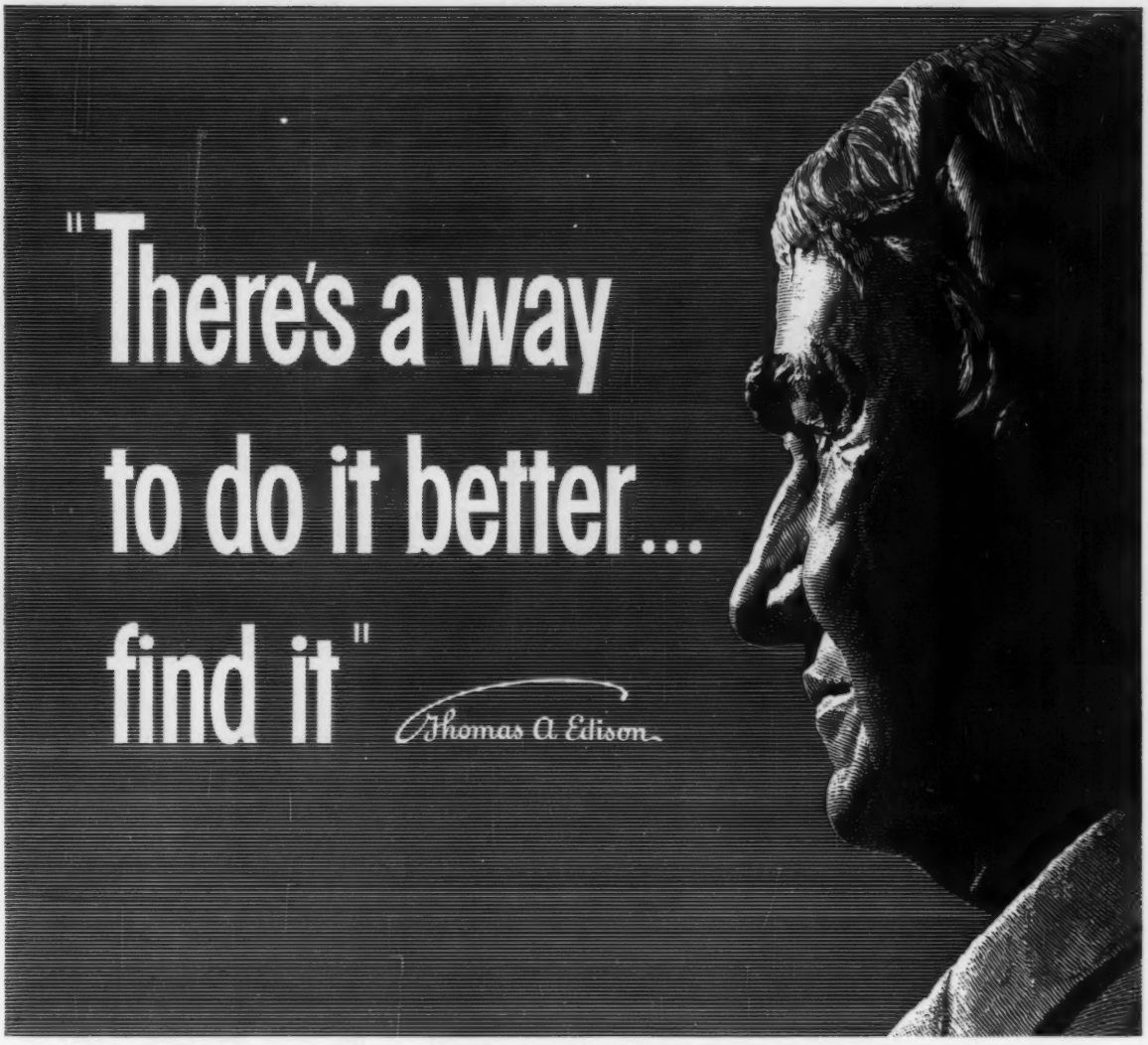
. . . is dust-tight unit for Class II, group E, F, and G, and Class III locations. Designed for 200-w lamp, it has 52% output in zero to 60-deg zone and 86% output overall.

Stainless steel bales and cam latches support glass from underneath. Gasketed aluminum fitter locks against glass under pressure to assure positive closure. Design prevents entry of dust or moisture in power plants and in chemical, petroleum, textile, food, and similar industries.
Holophane Co, Inc, 342 Madison Ave, New York 17, N. Y.

Load Banks . . .

. . . for artificial electrical loads are available in ratings from one to 70 kw per unit, 600 v max. Unit consists of standardized metal framework, pre-wired resistance elements, terminals for external connection, and load switching components where needed. Bulletin 39 has further data.
Ward Leonard Electric Co, 115 MacQuesten Parkway S, Mt Vernon, N. Y.

(*More New Products on page* 88)



With those words, Thomas A. Edison, whose 111th birthday we celebrate on February 11th, set forth the principle that was to guide his inventive genius. Holder of more patents for basic inventions and improvements than any other man, Edison pioneered in harnessing the power of electricity for the benefit of mankind.

The electric age we now live in has gone far beyond even Edison's dreams. The force that he tamed has been expanded and developed until today it serves us all and contributes immeasurably to our whole standard of living. Thanks in large part to the vision and ingenuity of the Electric Light and Power Companies, "Housepower" today staffs most American homes with a minimum of nine electric servants. Industrial power gives every U. S. worker the equivalent energy of 279 assistants.

At McGraw-Edison, ever mindful of our great heritage, we strive continually to find a "better way." This constant search leads to the quality found in the literally thousands of products we make for the more efficient distribution and use of electricity.

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MORE NEW PRODUCTS

Large **selenium rectifiers,** in sizes up to 12 x 15 in., reduce the number of parallel paths needed for high current applications. Cell voltages include 15, 18, 22, 26, 33, 40, and 45v rms—Syntron Co, 205 Lexington Ave, Homer City, Pa.

Type SD **overload relays** provide full 3- or 2-phase protection without additional space, permit accurate field adjustment over motor current range of about 25%—Rowan Controller Co, 2315 Homewood Ave, Baltimore 18, Md.

Automatic **viewer-enlarger-processor** makes 18x24-in. prints from unitized microfilm in less than a minute. Magnification for viewing is 20x.—Ozalid Div, General Aniline & Film Corp, Johnson City, N. Y.

Adjustable **vapor and liquid proof lighting fixtures,** Series K-150, have 150-w sealed-beam reflector flood lamps and are shock mounted to prevent filament whip—Lighting Div, Woodward Machine Co, 4833 Elmhurst Ave, Detroit 4, Mich.

Infrared oven sections that accommodate metal rods, quartz lamps, or quartz tubes are available in widths of 5.5 and 11 in. Reflector may be specular gold or aluminized steel in this series, designated 51-000 and 52-000—Fostoria Pressed Steel Corp, Fostoria, Ohio.

Class 2510 integral-hp **manual starters** for motors up to 7.5 hp are available in NEMA sizes 0 and 1. Rated up to 600 v ac or 250 v dc, they have positive action toggle with no dead center position.—Square D Co, 4041 N. Richards St, Milwaukee 12.

Silicone rubber compound 81,726 that vulcanizes at room temperatures is designed for filling voids, sealing, and cushioning electrical equipment and assemblies. It has high flame resistance, good high and low temperature performance, and superior electrical properties.—General Electric Co, Silicone Products Dept, Waterford, N. Y.

(*More New Products on page* 90)

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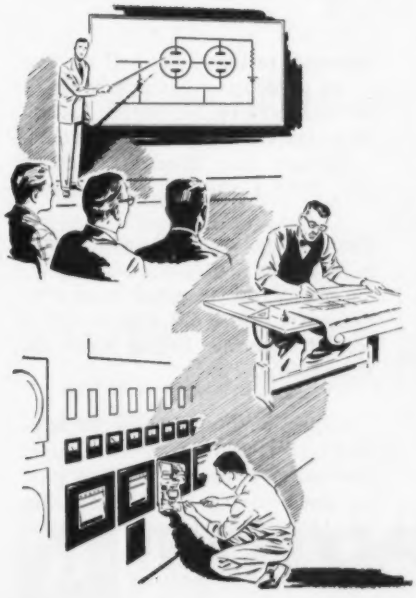

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Model 820 **thermostat** for electric space heaters is smaller than pack of cigarettes, accurate to within 1 deg, has 35 to 90-deg range. Twenty and 22-amp models are available.—Mears Electric Controls, Swan Island, Portland 11, Ore.

Tubular **infra-red heaters,** called Vicoray, can be used for variety of industrial applications at ambient temperatures up to 1,000F. Units range from 500 w to 36 kw and from 11 to 48 in. 120 and 240-v models are offered—D. C. Whitaker Co, Inc, 141 E Glenside Ave, Glenside, Pa.

General purpose, sealed, **nickel-cadmuim batteries** can deliver peak currents up to 20 times normal rating, have flat discharge and long life. VO Series includes capacities from 0.1 to 160 amp in multiples of 1.2 v.—Gulton Industries, Inc, 212 Durham Ave, Metuchen, N. J.

Fincor **ac motor control package** has efficiencies comparable with variable speed dc motor drives. Size range includes 1/6, ¼, ⅓, and ½ hp.—Fidelity Instrument Corp, 1000 E. Boundary Ave, York, Pa.

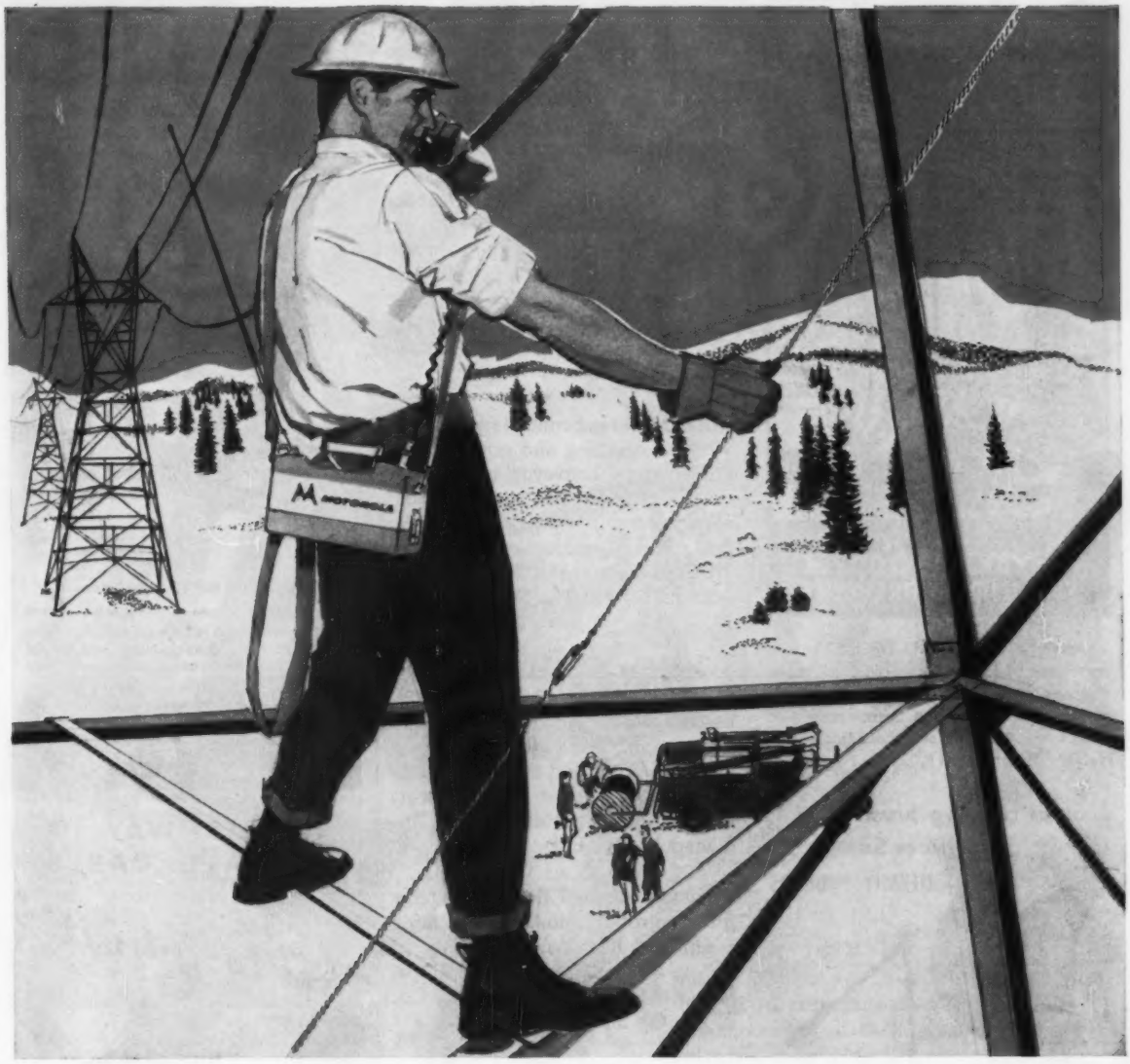
Model HCVS-106-A automatic switchover **regulated power supply** provides constant current and voltage for precision etching, electroplating, or other electro-chemical processes. Has ranges of 0-20 amp and 0-100 v.—Matthew Laboratories, 146 Riverdale Ave, Yonkers, N. Y.

Selenium rectifier only half the size of its predecessors is offered in 6-cell ratings of 18, 22, 26, 30, 33, and 36 v. Bulletin 3116-1 has more data.—Vickers, Inc, Electric Products Div, 1815 Locust St, St. Louis 3.

Electric **thermostat** for temperatures to 700F controls three separate heating phases, one of which is on continuously. Rated 20 amp at 250 v ac.—Robertshaw Fulton Controls, Youngwood, Pa.

Flexible **pipe insulation** for temperatures up to 2,000 F is woven ceramic fiber tape. It can be used on pipe dia down to 0.5 in.—Russell Mfg Co, Middletown, Conn.

(*More New Products on page* 92)



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SAYS HARRY M. LEWIS, SUPT. OF COMMUNICATIONS, CALIFORNIA OREGON POWER COMPANY

Over canyons, streams and mountains, as well as in heavily populated urban areas, Motorola 2-way radio is helping The California Oregon Power Company construct and maintain electric service *faster, more efficiently* and at *less cost.*

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Superintendents and other key men are freed from their desks—can be reached on the job or in their cars. Survey parties and wire stringing crews use HANDIE-TALKIE portables to communicate, spanning long reaches faster and better—saving *hundreds* of dollars every day. Repair crews are more productive—get lines back in operation faster, keeping customers better satisfied. Line patrols in tractors and helicopters work safer and more efficiently with radio.

Whatever the job—Motorola 2-way radio can help you speed it at less cost. Specify Motorola for the most dependable, uninterrupted mobile communications. For a Motorola communications specialist on Power Utility problems—write, wire, or telephone.

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Illustrated above is No. 11 Tree Pruner with center cut action by tempered steel blade that easily handles 1" branches. Head is reinforced malleable iron. Spruce poles with telescoping aluminum joints. For heavier work No. 12-18, capacity 1½". Also Pole Saws.

for clearing brush...

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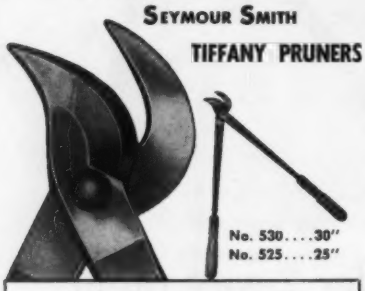

Hand forged throughout. Fast and easy double cut action with thin blades shaped to "draw in." Improved bolt and nut joint, through handle and riveted grip fastening.

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Blades of Swedish charcoal steel. Large, deep teeth with heavy set to prevent binding. Hand and Pole models for all work up to chain sawing.

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E-Z-Red **load center** handles 15 to 50 amp circuit breakers, single and double pole. Indoor or outdoor types with 6 to 8 circuit capacity, are for 3 wire service, solid neutral 100/240 v ac.—Wadsworth Electric Mfg Co, Covington, Ky.

Heavy-duty electric **jet cleaning equipment,** the Hydro Steam Jet Cleaner, provides scalding water and/or saturated steam at pressures to 185 psi. Available for 220, 440, or 550 v, 3 phase.—Pantex Mfg Corp, Box 660, Dept SG, Pawtucket, R. I.

MEK 2129 **load control** for feed devices on crushing and grinding machines stops conveyor or slows it down when crusher is overloaded, allows automatic restarting of the feed. Maximum load level and reset are adjustable.—Machinery Electrification, 56 Hudson St, Northboro, Mass.

Model AM-33 **radiation monitor** immediately measures exact amount of both alpha and beta-gamma activity in airborne particles. For use at reactor sites and in research laboratories. — Nuclear Measurements Corp, 2460 N. Arlington Ave, Indianapolis 18, Ind.

Miniature **thermal time delay** relay for control of inductive heating equipment has 3-amp capacity at 115 v, 60 cps and timing ranges of ¼ sec to 3 min.—Line Electric Co, 271 S. 6th St, Newark 3, N. J.

Six-in. dia **submersible pumps** which can be installed in wells as deep as 700 ft are available in 5, 7½, 10, and 15 hp sizes. Top capacity at 50-ft depth is over 13,000 gal an hr.—F. E. Myers & Bro. Co, Ashland, Ohio.

Memory meter for remote locations or other uses where reading can not be noted immediately is available with ranges up to 50 amp or 500 v, ac or dc.—Assembly Products, Inc, Chesterland, Ohio.

Mark II 60-w precision **ultrasonic drill** can shape square, crescent, or other odd-shaped holes. Can also cut, slice, or blank.—International Electronics Corp, 81 Spring St, New York 12, N. Y.

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Copper Bonded Sectional Ground Rods

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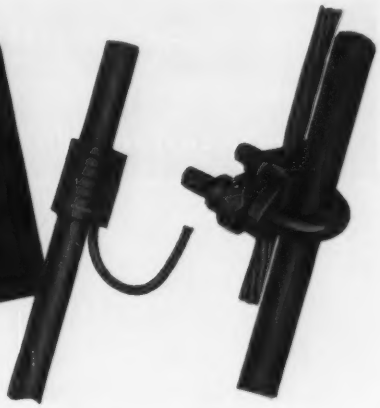

Copper Bonded Pigtail

Type GUV
U-bolt ground clamp parallel or 90°

Type GG
Ground Rod Clamp
Socket set screw

Type GGH
Ground Rod Clamp
Square head bolt

Type B
Budget Line Ground Rod Clamp
Square head bolt

Type GP 100
Electrolytic Copper Pole Bottom Plates
7½", 10", 14" dia.

Blackburn grounding devices will save you thousands of dollars annually in preventing burnouts of expensive overhead equipment. This complete line simplifies your stocking problem—one source for all your needs. Like all BLACKBURN products they are constructed of high-strength corrosion resistant materials—designed for easy installation and engineered for long-lasting, trouble-free grounding. Always specify BLACKBURN.

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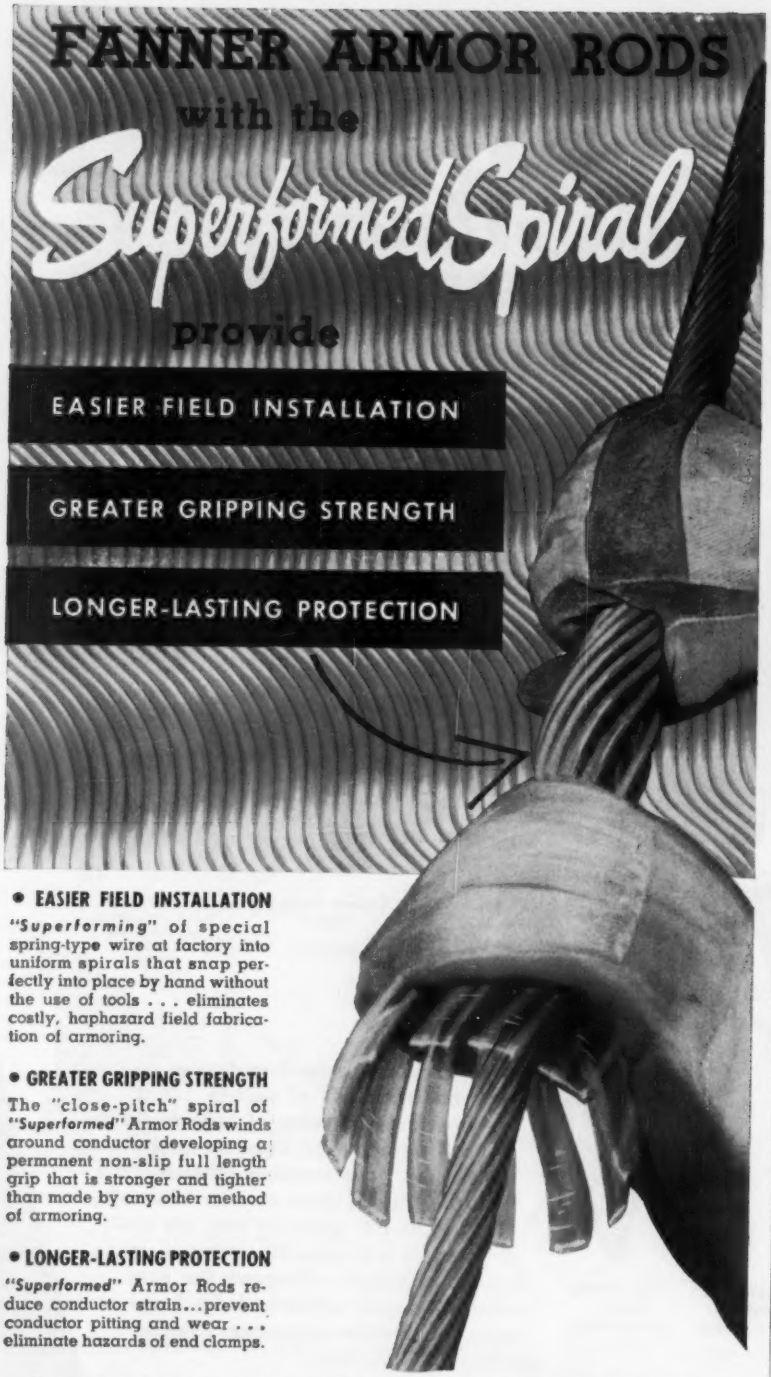

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• GREATER GRIPPING STRENGTH

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Books

A-Power for Engineers

Nuclear Engineering. Edited by Charles F. Bonilla. Published by McGraw-Hill Book Co, 330 W 42nd St., New York 36, N. Y. 801 pages, illustrated. Price $12.50.

This book presents the basic principles of the main engineering disciplines involved in the design of nuclear reactor cores and power plants. The material is written by twelve outstanding experts in various fields of engineering and science.

The difference between this and previously published books in the field is the emphasis that is given to engineering aspects of reactor and nuclear power plants. Detailed and extensive treatment is given to such engineering subjects as fluid flow, heat transfer, stress analysis, and power cycles. Basic nuclear and reactor physics is also included. The non-engineering subjects of radiation protection and the legal aspects of nuclear power round out the book. Excluded from the text is material on preparation and reprocessing of fuel elements.

The book is intended as a text for a graduate course for engineers and physics majors. As such, it is written with rigorous mathematical accuracy. However this should not deter the practicing engineer from using the book.

Any review of the mathematics that is required will be well rewarded by the completeness with which the book covers the engineering aspects of nuclear power. It can serve as a very useful reference book.

Although there are no formal subdivisions, the book conceivably can be divided into four basic sections: Physics fundamentals; engineering fundamentals; engineering application; and, legal problems.

The physics fundamentals cover the first seven chapters and take the readers from the historical data about the nuclear process to the elementary design of reactors. The latter part of this section contains some of the most rigorous mathematics in the book.

Fluid flow, heat removal, thermal-stress analysis, mechanical design, and uranium metallurgy are next presented in the book. Uranium metallurgy is, of course, peculiar to nuclear energy but the other subjects are fundamental mechanical engineering topics. This book discusses these subjects as they pertain to a nuclear power plant.

A very complete chapter on power generation indicates the problems and economics of applying nuclear energy to the production of electricity. It is followed by an excellent discussion of reactor types, their cycles, and advantages and disadvantages.

The closing chapter gives a summary of the legal aspects of this new type of energy.

HAGAN RING BALANCE FEATURES—NO. 1

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UNIQUE RANGE CALIBRATION SYSTEM PROVIDES HIGH SENSITIVITY AT LOW FLOWS

Low-flow sensitivity is a built-in feature of the Hagan Ring Balance flow meter. Rotation of the ring, in response to differential, is governed by the adjustable range spring in accordance with the unvarying trigonometry of the range calibration mechanism. This is expressed by the formula:

$$\text{Spring deflection} = R(1-\cos\theta) - L(1-\cos\phi),$$

and is graphically illustrated at the right. The upper curve shows that the ring motion at low range exceeds the requirement to produce pen motion linear with flow. Thus, the cam which transmits ring motion to the pen arm can convert this excess ring motion into extra power for precise pen movement.

METERING APPLICATIONS WHICH REQUIRE WIDE TURN-DOWN CALL FOR HAGAN RING BALANCE METERS. You get this feature when you specify Hagan, as well as the following:

1. Ease of calibration under operating static pressures with factory calibrated check weights! No more four-story water columns and telephones!
2. Safe operation with rings rated at 2,500, 10,000, 15,000 psig. No gaskets, no stuffing boxes.
3. Sealing fluid density and level not critical. No eyedroppers required.
4. Interchangeable ring assemblies for full scale ranges from 0.5" w.c. to 560" w.c. Adjustment on any one ring over a 7:1 differential range.
5. Wide range computation and/or compensation by means of built-in, easily checked mechanisms available on most models.
6. Pneumatic or electric transmission also available.

Bulletin MSP-141 describes these features and the new design of the Hagan Ring Balance meter case. ASK US FOR IT.

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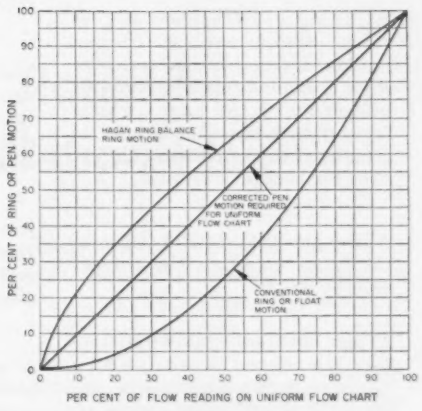
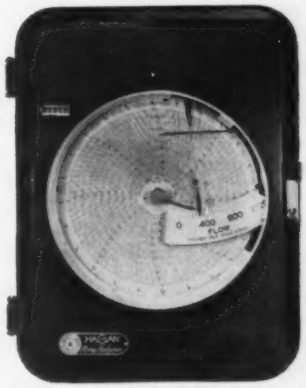
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED, TORONTO

Push rod moves upward against range spring, governing ring rotation in accordance with the diagram below.



Excess motion of the Hagan ring, as shown by upper curve, is converted (with a gain in torque) into linear pen movement by a gently sloping cam.



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Dissimilar, non-ferrous metals, including aluminum, copper, magnesium, titanium, brass, zinc, silver and gold can now be bonded by a new ion-exchange process.

&

Doppler radar, installed in aircraft, is being tested by commercial transport planes. If satisfactory, it is expected to have far-reaching effects on civilian navigation.

&

By using a 3800-gallon bag of rubber-coated rayon to contain liquids, a truck trailer can now serve a double purpose. Various linings make the bags suitable for corrosive or edible liquids. It is planned to make them in larger sizes for barges or storage.

&

A new pencil feeds lead automatically to maintain the correct writing length.

&

A new low-temperature laboratory is equipped to produce fifty quarts an hour of liquid hydrogen at −423°F. and eight quarts an hour of liquid helium at −453°F.

&

A color-video tape recorder-player has been announced.

&

A new off-shore drilling platform is able to operate in 600 feet of water. Present equipment is limited to about 100 feet.

&

A model of an ion-propelled rocket has been exhibited. Theoretically it should have an efficiency of 90 per cent and a speed of 25,000 miles per hour. Power would be derived from a nuclear reactor.

A mechanical construction kit for adult tinkerers contains 5,000 parts. It is claimed that a working model of almost any machine can be built with it.

&

One of the new European cars has three headlights mounted side-by-side behind a screen of curved glass. The middle lamp is pivoted and turns with the wheels.

&

A single drop of a new adhesive, used to join two pieces of metal, has supported a load of 5,000 pounds.

&

Paint that changes color at high temperatures is being used in oil refineries as a safety measure.

&

Man-made lightning, to test insulated cable, is produced by the new 1,400,000-volt impulse generator in the Simplex research laboratories.

&

A new fuel for jet and ramjet engines has a boron-hydrogen base and should increase the range of aircraft using it by forty per cent.

&

A new kind of "electric eye" uses radiation from a small amount of strontium-90 instead of an electric light. It requires no power supply and is not subject to interference from dust or smoke.

&

A twenty-five acre business center, being built in Venezuela, is in the form of a helicoid. It will be 365 feet high and access will be by a spiral ramp. At the top will be a 170-foot aluminum dome housing an exhibition hall and television station.

&

A generator has been designed that produces electric power directly from the chemical reaction of hydrogen and oxygen.

Since 1950, over 4000 miles of cable protected by Simplex C-L-X type sheaths have been put in service. No sheath failures have been reported.

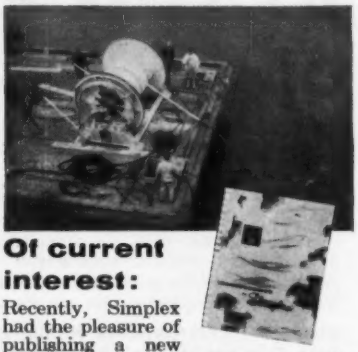
&

A new eighteen-pound refrigerator will operate for fifty hours on a bottle of propane gas, or indefinitely on household current.

&

The problem of shipping giant transformers by rail has been minimized by making the transformer the central part of the car. Both height and weight are thereby reduced.

&



Of current interest:

Recently, Simplex had the pleasure of publishing a new book called TRANSOCEONICS, depicting the historical development of underseas telephone cables. If you have read TRANSOCEONICS, you will recall the magnitude of some of the projects undertaken by Simplex.

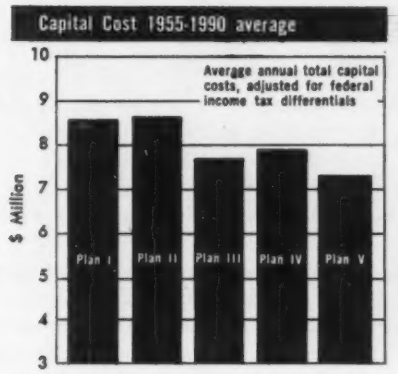
We hope you will also remember that Simplex manufactures cable for nearly every electrical need, regardless of project size. All the proficiency acquired during our seventy years of leadership in cable manufacturing and research is at your disposal. Call or write to:

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

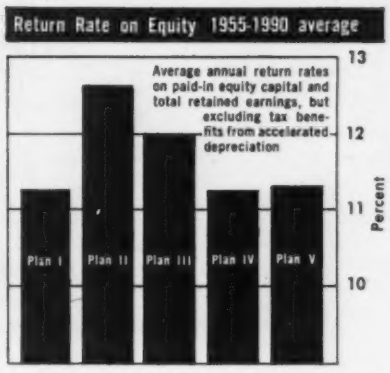
Simplex

Highest quality cables for: Mining
Power & Lighting • Construction
Transportation • Communications
Signalling

"the American manufacturers of transoceanic telephone cables"



Plan III features next-to-lowest costs of capital among the five plans studied. This works to the customers' benefit



. . .and under Plan III the rate of return on common equity is next-to-highest. This is advantageous to the stockholders

Customers, Stockholders Both Benefit from New Accelerated Depreciation Plan

The charts above can help break up the clouds surrounding use of accelerated depreciation by electric utilities. The blackest cloud has been the question of who was to get the benefit of the temporary tax savings that result—the company or the customers. Plan III gives a compromise answer—both get the benefit.

This compromise is the product of several analysts of the utility industry. As the charts show, it holds down the capital cost to the consumer and at the same time provides a generally higher rate of return on equity capital than do the other plans—which helps the company and its stockholders.

The Internal Revenue Act of 1954 allows companies to depreciate their plant and equipment faster for tax purposes than the normal straight-line method of write-off. Congress set this up to encourage plant expansion—the tax savings realized could be temporarily reinvested in the company to help finance growth. Since equipment would first be depreciated faster than usual, then slower, no permanent tax saving could be realized. But the company could use the money saved for a while—as an interest-free loan from the government.

In regulated utilities clouds gathered quickly. Electric companies, expanding rapidly to keep ahead of their load, wanted to take the full advantage of accelerated depreciation that Congress had apparently intended. They wanted to use their tax savings as temporary capital to finance new construction. But some

(*more*)

commissions ruled that all money a utility company saved on taxes should "flow through" directly to its customers in the form of rate reductions.

Confusion over the destination of these tax savings has led many electric companies not to take advantage of them at all, but to continue depreciating their property for tax purposes by the old straight-line method.

A "typical" electric utility with gross plant and cash working capital around $80 million asked Gilbert Associates, Inc, a New York consulting firm, for advice. A comparison of five "plans" resulted. Plan I is straight-line depreciation. Plan II is accelerated depreciation with the utility allowed to keep all tax savings as temporary capital. Plan IV is accelerated depreciation with all tax savings flowing through to the customers. In Plan V, the company is forced to invest tax savings from accelerated depreciation without any compensation for the risks involved.

Plan III is the compromise. Here is how it works.

The company reports depreciation for tax purposes on an accelerated basis (the sum of the years-digits method worked out best in the example.) But the regulatory commission calculates the tax cost on the basis of straight-line depreciation for tax purposes. The tax savings generated are kept on the company's books as retained earnings—part of equity capital. So far, the procedure is the same as in Plan II.

But under Plan III the commission provides for the customers by applying a negative interest factor to the capital cost portion of the rate formula. This, in effect, reduces the return allowed the company for capital costs by an amount equal to the "interest" on the tax savings at the going interest rate for risk-free capital . . . as shown below:

Here's an Example

An electric company's capitalization is made up as follows:

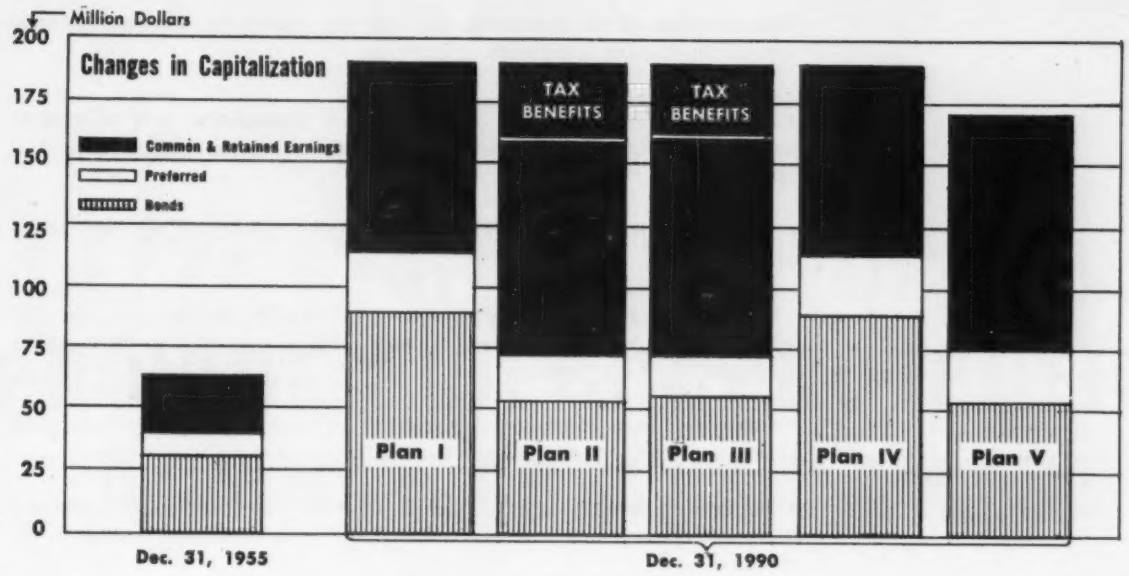
$50 million in bonds at 4%
$15 million in preferred stock at 5%
$35 million in common stock and retained earnings, including $5 million of tax savings in the accelerated depreciation reserve.

Under Plan II, that portion of allowable return to cover costs of capital would be approximately $6.8 million.

But under Plan III, the negative interest factor (4%) applied to the $5 million worth of tax savings would yield a $200,000 "interest" element flowing to the customers. Therefore, the regulatory commission allows not a $6.8 million return, but only $6.6 million—and if the company's return exceeds this figure, it must cut its rates.

The credit will tend to increase as the company's accelerated depreciation reserve increases.

Under this system, the customers get the advantage of a lower allowable return to cover capital costs of the company, and therefore, lower rates. At the same time, the company gets several advantages.



Percentages of Capitalization

	Dec. 31, 1955	Dec. 31, 1990 Plan I	Plan II	Plan III	Plan IV	Plan V
Common and Retained earnings (incl. Tax benefits)	35.02	40.03	48.75	46.92	40.03	40.88
Preferred	15.06	13.21	10.75	10.75	10.75	13.24
Bonds	49.92	46.76	40.50	42.33	46.76	45.88

First, the company gets to use its tax savings as capital at low cost. Second, the company gets to use this money without hurting its equity position, although it must bear all the investment risks. If the company had issued 4% bonds for the money, its interest charge would have been the same. But these bonds would have increased the percentage of capital in debt, with adverse effect on common equity costs. In order to keep its equity position and still raise the money, the company would have had to issue more common stock, at a rate of 10% to 13%. The difference in cost to the company of raising the capital represents the stockholders' share of the benefits of accelerated depreciation.

This is a substantial advantage. In the "typical" utility studied, the net tax saving generated by the sum of the years-digits method of accelerated depreciation amounted to more than $21.5 million over a 35-year period.

In the study of that company, several assumptions were made: 1. Corporate income tax rate will remain at 52% throughout the period of the study—1955 to 1990. **2.** Cost of bond money will slide gradually until 1960, then stabilize a bit below present levels. **3.** All expenses of the company, except cost of capital, would be the same regardless of the "plan" used. **4.** The company's growth through 1990 will be 167% (this is conservative by industry standards).

(*more*)

Here are some of the conclusions (for that one utility) that may have general application to other companies:

• Intent of Congress in allowing accelerated depreciation was to provide temporary funds to finance continued expansion and modernization of physical plant.

• There is no reasonable basis for denying these benefits to regulated utility companies.

• When tax savings flow through to customers (Plan IV), utilities get no benefit. When tax savings are not counted as capital (Plan V), benefits to the company are negligible if not negative.

• Tax savings from accelerated depreciation are temporary. Savings made early in the life of property must be paid back to the government later in its life.

• The compromise plan (Plan III) gives the utility the benefits of accelerated depreciation which Congress intended, and still gives substantial benefits to the customer.

• Long-term cost to the customer is actually lower under Plan III than under Plan IV—where all tax savings flow through directly to him. Today's customers benefit under plan IV, but tomorrow's customers suffer as the flow reverses and the tax savings must be paid back to the government. In the words of the Gilbert report: "Plan IV, of course, carries the distinct disadvantage of paying Paul today in order to legalize the robbing of Peter at a later date."

Box Score:
Consumer capital costs by 5-year increments.

Average Capital Costs* at Consumer Level

	Costs ($1,000)				
	Plan I	Plan II	Plan III	Plan IV	Plan V
1956–60	4,463.1	4,463.1	4,398.7	4,199.1	4,402.3
1961–65	5,853.9	5,862.9	5,634.6	5,330.7	5,496.6
1966–70	7,312.1	7,351.4	6,864.7	6,579.2	6,611.9
1971–75	8,743.8	8,738.5	7,932.9	7,919.7	7,555.8
1976–80	9,924.0	9,937.3	8,787.7	9,112.4	8,387.6
1981–85	11,030.6	11,067.9	9,551.0	10,319.5	9,141.6
1986–90	12,414.7	12,509.9	10,679.1	11,977.0	9,981.2

* including differential tax costs

The compromise plan for distributing the benefits of accelerated depreciation carries one big advantage over the other methods. It recognizes all interests. It provides a practical basis for regulatory commissions to clear the haze around accelerated depreciation, and allow more utilities to take advantage of it, to the mutual advantage of themselves, their stockholders, and their customers.

Further details of the study are available from Malcolm G. Davis, vp, Gilbert Associates, Inc, 61 Broadway, New York 6, N. Y.

NOW...

DELTA-STAR TRANSFORMERS* PROVIDE BUILT-IN PROTECTION AGAINST COSTLY DAMAGE

OVERALL **SELF-PROTECTED**

3+kva to 100+kva; SINGLE PHASE; 15,000 VOLTS AND BELOW

*PATENTS APPLIED FOR

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge and Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, H. K. Porter Company (Canada) Ltd.

OVERALL SELF-PROTECTED DELTA-STAR TRANSFORMERS*

offer you all of these modern features...

Delta-Star engineers have used an outstanding new concept in SELF-PROTECTED Transformers. Into it have gone the most modern materials and methods. The quality and excellent design of the Delta-Star OVERALL SELF-PROTECTED Transformer reflects the experience and reputation of Delta-Star in the lightning arrester and power switching fields.

COVER

Assures positive seal—and natural shedding of water. One-piece non-corrosive clamping band with re-usable nitrile rubber gasket.

TERMINALS

Tin-plated bronze alloy. Spring-loaded to accommodate aluminum or copper conductors.

COIL

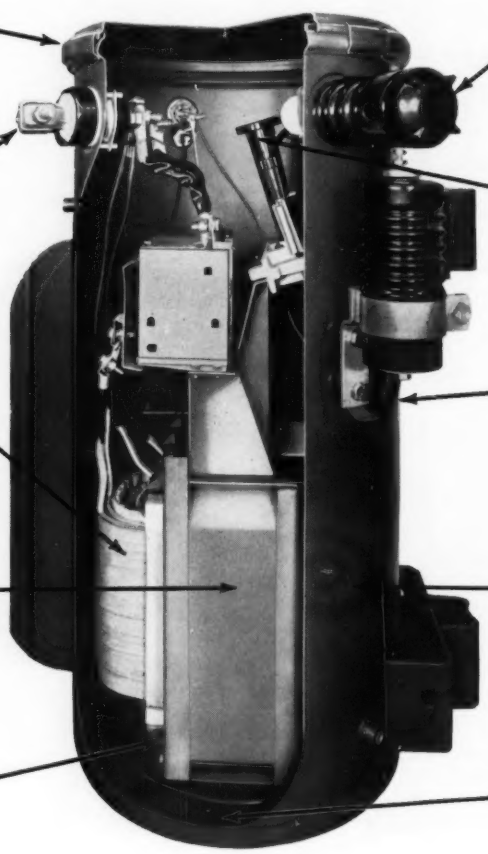
Heavy Formvar wire. Wound with liberal insulation. Ducts provide maximum, uniform cooling.

PORTER CORE

Grain-oriented cold-rolled silicon steel. Assures low losses, smaller tank, minimum weight.

CORE-COIL ASSEMBLY

Will not shift under severest handling conditions. Securely anchored to tank wall. Positively braced against short circuits.



BUSHINGS

Double-keyed—connector to porcelain—porcelain to tank. Assures positive lock against rotation.

TAP CHANGER

Positively positioned. Liberal voltage creepage distance. Handle grip above oil. Shorting bar under spring tension.

TANK

Design minimizes number of external parts. Pressure-tested for perfect sealing. Reinforced bottom edge.

FINISH

Provides maximum corrosion protection. Special metal preparation prior to alkyd painting. All primer and finish coats baked.

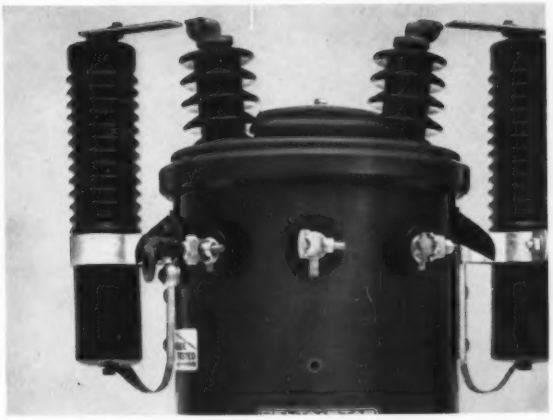
INHIBITED OIL

Gives extended life with better insulating characteristics. Specially processed immediately before filling.

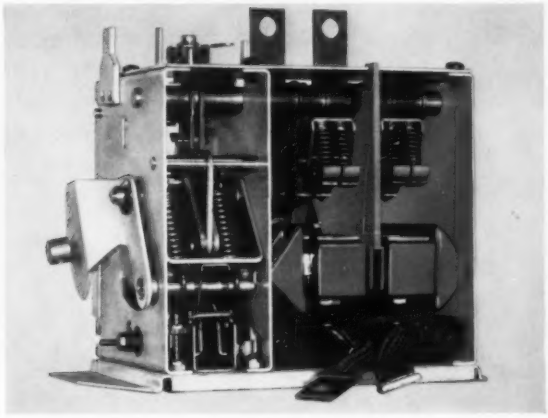
*PATENTS APPLIED FOR

H. K. PORTER COMPANY, INC. DELTA-STAR ELECTRIC DIVISION

these special features provide overall self-protection

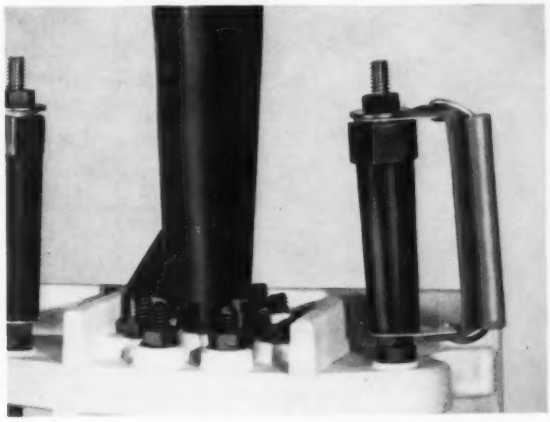


External Gap Crystal Valve Arresters Offer Positive Protection. Coordinated valve type arrester has increased arc suppressive ability and surge current-carrying capacity. Transformer is protected from line surges. Integral mounting of valve type arrester reduces installation costs.



Circuit Breaker Has 20% Increase In Rating. Uprated at the factory, breakers offer maximum available overload capacity. Modern design with reduced size permits smaller tank and greater accessibility. Externally operated overload device allows excessive short time overloads without damage to the unit.

Operating Handle Prevents Accidental Tripping. "Reset-open-closed-light." Unique operating sequence prevents accidental tripping. Simple movement from "closed" to "light" resets the signal light. The same movement allows lineman to test the overload lamp without removing it. Light positioned for optimum visibility.

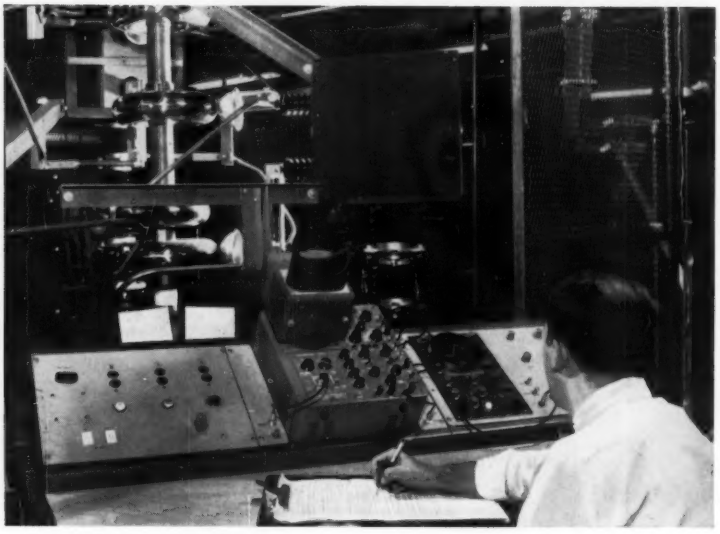


Fuse Acts As Safeguard. The fuse offers additional protection and is easily accessible for simplified maintenance. Fuse clears the line in the event of an abnormal condition. It is one of the many safeguards which afford overall self-protection to Delta-Star Transformers.

H. K. PORTER COMPANY, INC. DELTA-STAR ELECTRIC DIVISION

DELTA-STAR TESTING

assures consistent transformer quality



Impulse Test Area. Here Delta-Star engineers give impulse tests to each transformer produced. The OVERALL SELF-PROTECTED Transformers are impulse-tested prior to mounting the arrester. Other test areas are also thoroughly equipped.

Quality control is more than just final tests. Delta-Star's quality control begins at the laboratories where materials and procedures are developed. It continues with the testing and inspection of incoming materials, through the manufacturing process, and up to the final production tests. Delta-Star does all this and more. It protects the quality of its transformers by shipping them in easily-handled, high-strength crates.

FREE CATALOG. For complete information on Delta-Star OVERALL SELF-PROTECTED Transformers, write *Delta-Star Electric Division, H. K. Porter Company, Inc., 17th & Cambria Sts., Philadelphia 32, Pa. District offices in principal cities.*

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge and Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, H. K. Porter Company (Canada) Ltd.

The Meetings Calendar

FEBRUARY

Edison Electric Institute — Electrical Equipment Committee, Dayton Biltmore Hotel, Dayton, Ohio, Feb. 10-11; Commercial Lighting Committee, New Orleans, La., Feb. 10-11; Transmission & Distribution Committee, Lord Baltimore Hotel, Baltimore, Md., Feb. 11-12; Residential Promotion Committee, New York City, Feb. 13-14; Electric Space Heating & Air Conditioning Committee, Birmingham, Ala., Feb. 13-14; Commercial Cooking & Water Heating Committee, Washington, D. C., Feb. 17-18; Meter & Service Committee, Sheraton Hotel, Philadelphia, Pa., Feb. 17-19.

American Public Power Association—Engineering & Workshop Meetings, Chattanooga, Tenn., Feb. 13-14.

National Society of Professional Engineers—Spring Meeting, Michigan State University, East Lansing, Mich., Feb. 13-15.

Pennsylvania Electric Association — Relay Committee Winter Meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., Feb. 13-14; System Planning and Transmission & Distribution Committees Joint Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa. Feb. 20-21; Electrical Equipment Committee Winter Meeting, Hotel Roosevelt, Pittsburgh, Pa., Feb. 27-28.

Puget Sound Electric League — Pacific Northwest Electrical Industry Exposition, Civic Auditorium, Seattle, Wash., Feb. 14-16.

American Institute of Mining, Metallurgical, and Petroleum Engineers—Annual Meeting, Hotel Statler, New York City, Feb. 16-20.

National Wiring Sales Conference — Statler Hotel, Detroit, Michigan, Feb. 20-21.

MARCH

Southern Safety Conference, Inc—Exposition, Peabody Hotel, Memphis, Tenn., March 2-4.

Right of Way Meeting — Electrical World's second conference on R/W practices, procedures, and problems, Conrad Hilton Hotel, Chicago, Ill., March 6-7.

Pacific Coast Electrical Association — Business Development Section, Statler Hotel, Los Angeles, Calif., March 6-7; Engineering & Operation Section, Sheraton Palace, San Francisco, Calif., March 27-28.

Lighting Lamps and Electrical Manufacturers Salesmen's Association—First National Lighting Exposition, Coliseum, New York City, March 9-12.

Public Utilities Advertising Association—Regional Meeting, Montreal, Canada, March 13-14.

Nuclear Congress—Co-sponsored by American Society of Mechanical Engineers and the Engineers Joint Council, International Amphitheater, Chicago, Ill., March 16-22.

Interstate Power Club — Hotel Martinique, New York City, March 17.

National Association of Corrosion Engineers—Annual Conference & Exhibition, Municipal Auditorium, San Francisco, Calif., March 17-21.

American Institute of Electrical Engineers and American Society of Mechanical Engineers—Joint Management Conference Committee, Hotel Somerset, Boston, Mass., March 19-20.

Edison Electric Institute — Industrial Relations Committee, Headquarters, New York City, March 20; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., March 24-27.

Institute of Radio Engineers—National Convention, Waldorf-Astoria Hotel and New York Coliseum, New York City, March 24-27.

Northwest Public Power Association — Engineering and Operations Section, Clark County PUD Electric Center, Vancouver, Wash., March 26-27.

American Power Conference—20th Anniversary Meeting, Sherman Hotel, Chicago, Ill., March 26-28.

Oklahoma Utilities Association — Annual Convention, Oklahoma Biltmore Hotel, Oklahoma City, Okla., March 27-28.

Electrical Maintenance Engineers Association of Southern California—Industrial Electric Show and Conference, Shrine Convention Hall, Los Angeles, Calif., March 27-29.

Southeastern Electric Exchange—Annual Meeting, Boca Raton Hotel and Club, Boca Raton, Fla., March 31-April 2.

APRIL

• **Rural Electrification Administration**—9th Annual Electric Generating Plant Operation and Maintenance Conference, Phoenix Hotel, Lexington, Ky., April 7-10.

• **Indiana Electric Association**—Young Men's Utility Conference, Evansville, Ind., April 8-9.

• **Microwave Research Institute** — Symposium on Electronic Waveguides held in cooperation with Institute of Radio Engineers, New York City, April 8-10.

• **Rocky Mountain Electric League** — Spring Conference, Shirley-Savoy Hotel, Denver, Colo., April 13-15.

• **American Institute of Electrical Engineers**—Rubber and Plastics Industries Subcommittee, Mayflower Hotel, Akron, Ohio, April 14-15.

• **Edison Electric Institute**—National Conference of Electric and Gas Utility Accountants, held jointly with AGA, Shamrock Hilton Hotel, Houston, Texas, April 14-16.

• **American Welding Society**—Sixth Annual Welding Show, and Technical Meeting, Kiel Auditorium and Hotel Statler, St. Louis, Mo., April 14-18.

• Additions this week.

MORE BIG DATES FOR '58

American Public Power Association—Annual Meeting, New Orleans, May 6-8.

National Association of Purchasing Agents — Annual Convention, Chicago, May 11-14.

Edison Electric Institute—26th Annual Convention, Boston, June 9-12.

American Institute of Electrical Engineers — Summer General Meeting, Buffalo, June 22-27.

National Electrical Manufacturers Association—Annual Meeting, Atlantic City, Nov. 10-14.

Lead Thickness Gage Plays A Major Role at Okonite Plant

An ultrasonic device, known as a Vidigage, has a major role in production of lead-sheathed cable at Okonite Co's Paterson, N. J., plant. As one step in quality control, this device is used to insure an adequate and uniform thickness of lead around the insulated conductors. Cost of the instrument has been recouped many times by the lead saving, by reduced shipping weight, and by a superior product for the end user, according to Arnold Bottari, process engineer of Okonite.

The Vidigage, a product of Branson Instruments, Inc, Stamford, Conn., is an ultrasonic resonance gage. It generates a frequency from 1.5 to 4 Mc per sec, which is sent into the lead. The resonant returning frequency, which appears as two or more traces on a cathode ray tube, indicates the thickness of the lead sheath. Gage accuracy is reportedly within 1 mil.

The gage offers advantages: (1) measures, from outside, the thickness of lead at any point along the cable's length, (2) shows average lead thickness, (3) is non-destructive in operation, (4) is portable.

The extrusion is continuous while the lead thickness is being measured. Readings are taken at four points on the circumference, spaced 90 deg apart. Information the gage provides allows the lead press operator to anticipate changes to keep thickness variations well within specified limits.

Tap Changer Redesigned For RT&E Transformers

An externally operated tap changer for distribution transformers was recently redesigned and repositioned by the RT&E Corp, Waukesha, Wis. The new body is molded in one piece and multi-skirted for long creepage and high surge strength. The material is wood-flour-filled phenolic of high thermal stability.

Contact is made through a bridging roller, under spring pressure. The roller is grooved around its periphery to give a double-contact surface for low resistance and cool operation. The switch is operated by removing the screw-on type cap, reversing it, and using it as a handle.

Advantages include ease of recognizing the tap setting and changing the tap position, and elimination of any need for entering the tank.

Stainless Steel Fence Installed at Linden Plant

A stainless steel fence which will resist industrial atmospheric conditions was installed recently at Linden Generating Station of Public Service Electric & Gas Co. This type of fencing was chosen because, though the initial cost is higher, it is practically maintenance-free.

Some 3,000 ft of 4-ft-high fence and 6,500 ft of 7-ft fence were fabricated by Cyclone Fence, American Steel & Wire Division, United States Steel Corp. Alloy additions for the stainless steel were supplied by Electro Metallurgical Co, New York.

Transformers Retired After 56 Years Service

Two transformers were retired recently after 56 years of continuous service in a Brooklyn, N. Y., shipyard. The transformers, made by General Electric Co, had supplied 25-cycle power for a large floating drydock until the shipyard recently converted that facility to 60-cycle power and replaced them.

The age of the transformers was discovered by tracing their serial numbers to GE's power transformer department at Pittsfield, Mass. There, dusty files, dated Jan. 7, 1901, revealed manufacturing specifications: So many turns of copper wire of a certain size, insulated with cotton tape, oiled linen and "horn-fibre;" and the fact that the transformers had been built in the company's Schenectady, N. Y., plant early that year.

Only service required in the 56 years was the rewinding of a coil of one unit in 1938.

Westinghouse Reports on Orders of $12 Million

• Westinghouse Electric Corp has supplied virtually all the electrical apparatus for Harvey Aluminum's reduction plant now nearing completion at The Dallas, Oregon. More than $7 million in electrical equipment will power the plant, which will use about 10 kwhr for every pound of aluminum produced. Harvey's planned capacity rate is 108-million lb a year. First molten aluminum is scheduled to be poured this year.

Electrical apparatus includes 32 ignitron rectifier cubicles, occupying a building two blocks long, outdoor transformers, voltage regulators, switchgear, circuit breakers, meters and controls. Bonneville Power Administration will supply power at 115,000 v ac, which will be converted to 700 v dc.

• Westinghouse has also received a $5-million order for electrical equipment for Mexico's oldest steel mill. Scheduled for a new flat products mill for the Cia. Fundidora de Fierro y Acero de Monterrey, S. A., the equipment order includes main drives and auxiliaries for a 66-in. hot strip finishing mill, a four-high reversing cold mill, and skinpass mills for hot and cold rolled strip. In addition, two 2,000-hp motors will power a three-high billet mill.

Simplex Has New Catalog

Simplex Wire & Cable Co, Cambridge, Mass., has a new catalog for its Anhydrex insulated cables. Sections include charts and data on the insulation for cables to 2000 v, and to 35,000 v. Also included are specifications and charactertistics for the cables as well as engineering information and current capacities. A folder describes Condex interlocked armored cables.

U. S. Aluminum Production

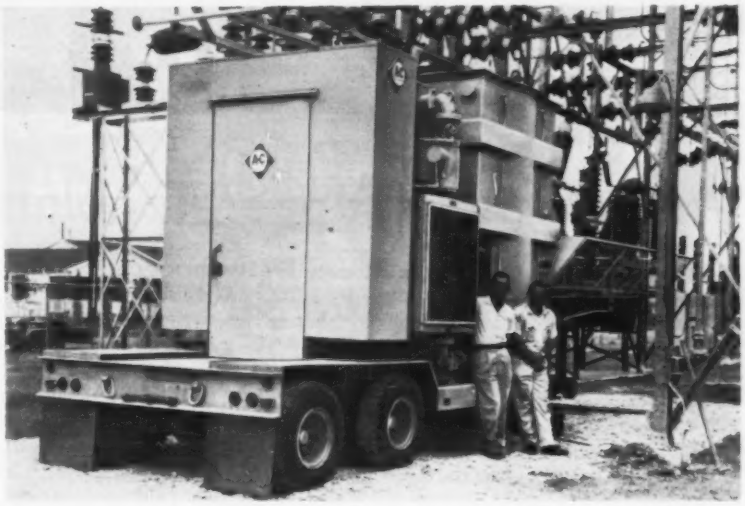
Primary aluminum production in the United States for 1957 totalled 1,649,013 tons, a drop of 30,234 from the 1956 figure of 1,679,247, reports the Aluminum Association, New York. But December was up to 141,335 tons, compared to 135,024 in November. December, 1956 showed 148,391 tons.

American Air Filter Co, Louisville, Ky., has developed a Roll-O-Vent packaged air-handling unit with automatic air filtration. The filtering media is a mat of slightly curled, interlaced, glass filaments fabricated into "blankets" approximately 65 ft long, tightly rolled on spools, and having a face velocity of about 500 fpm for average dust loads. Advantages include disposable media, once-a-year maintenance, and constant filter resistance. An installation has been made in an eastern generating station.

Curtis Musgrove Co has consolidated headquarters operations in a 12,000-sq ft warehouse and office building at 8909 Sovereign Row, Dallas, Texas. Other offices are in Ft Worth, San Antonio, Tulsa, and Houston (also a warehouse). The company represents: Federal Pacific Electric Co (High Voltage Division), Kuhlman Electric Co, Jasper-Blackburn Corp, Southern Electric Co, and Fulton Products Inc.

Holtzer-Cabot Motor Division, National Pneumatic Co, Boston, Mass., has signed an agreement with Elliot Brothers, Ltd., Lewisham, England, for the manufacture of Holtzer-Cabot instrument motors at the English factory.

Wiremold Co, Hartford, Conn., announces an almost 20% reduction for three 3-wire devices in their Plugmold 2100 series. This reduction applies to the polarized receptacle (2127-P), grounded outlet 15 amp, 125 v (2127-GA), and grounded outlet 15 amp, 250 v (2127-GB).

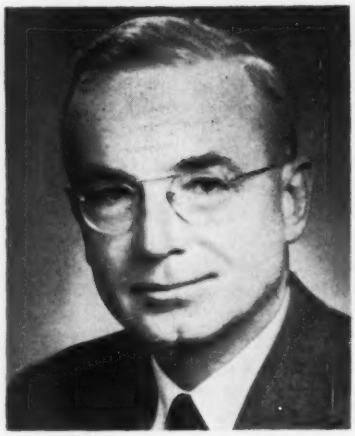


Texas Utility Gets Big Mobile Substation

A 7,500-kva, 69-kv mobile substation is shown providing service during an installation of Allis-Chalmers 750-kva regulators on the 12.5-kv bus in the main substation of Community Public Service Co at Texas City, Texas.

This 3-phase mobile substation is reported to be the largest built to date at Allis-Chalmers Pittsburgh Works. It uses a series-multiple delta-star switching arrangement.

Internal high and low-voltage switches and protective devices are provided on this trailer substation. The unit is oil-insulated and cooled by heat exchangers consisting of oil pumps for forced-oil cooling and fans for airblast cooling.



Hartford Utility Execs Named

Upon completion of the merger of Connecticut Power Co into Hartford Electric Light Co recently, Raymond A. Gibson was made president and Austin D. Barney became board chairman.

Joseph R. McCormick was appointed director of public relations of the newly organized utility, which has its general offices at Wethersfield. Main offices for the Hartford Division continue at Hartford.

Until the merger, Gibson had served as president of Hartford Electric Light since early in 1956. An electrical engineering graduate of Rensselaer Polytechnic Institute, he joined the Hartford utility 35 years ago. Since then he has been advertising manager, commercial manager, assistant to the vice president, sales manager, vice president, and executive vice president.

RAYMOND A. GIBSON

E. P. DUNLAEVY

S. A. JACOBS

J. J. CONLON

W. K. DUNBAR, JR

E. A. MITCHELL

Phelps Dodge Copper Appoints Key Executives

Phelps Dodge Copper Products Corp has elected Edgar P. Dunlaevy as executive vice president and S. Allan Jacobs as president of its Inca Manufacturing Division, Indiana. Both were made directors of the company.

Dunlaevy has served as a vice president since 1949. Jacobs, a VP since 1941, continues in that capacity in his new post.

Elected as vice presidents were John J. Conlon, former works manager of the Bayway (N. J.) Division; William K. Dunbar, Jr, previously manager of distributor sales for the company; and Earle A. Mitchell, most recently chief plant engineer at the Habirshaw Wire & Cable Division, New York.

In other promotions, Charles F. Moody was named works manager at Habirshaw; Lewis F. Buckman became Bayway works manager; and Walter C. Lawson was elected VP-western activities of Phelps Dodge Corp.

J. P. KELLER

GE Ups Keller, Burger

Lewis J. Burger and John P. Keller have been named general managers for the gas turbine dept and the small steam turbine dept, respectively, of General Electric Co.

Burger, former general manager of the gear motor and transmission components dept, has previous experience in GE's transformer labs and the power transformer dept.

Keller, general manager of the gas turbine dept since 1952, formerly held engineering and supervisory posts in the turbine, personnel, and production departments.

L. J. BURGER

Mathes Becomes VP

Frank L. Mathes, director of sales for Arrow-Hart & Hegeman Electric Co, has also been named a vice president. In his post, Mathes is responsible for directing and co-ordinating sales functions of all divisions responsible for the sales of wiring devices, motor controls, and switches.

In addition, Leslie A. Goodwin was appointed manager of distributor sales for the Wiring Device Division and Howard J. Varley was made sales manager of the company's Appliance Switch Division.

PERSONAL BRIEFS

Potomac Edison Co recently named **William F. Cowherd** commercial manager, Cumberland district. **Joseph R. Staley** became local manager at Charles Town.

John E. Sheasgreen of Westinghouse Electric Supply Co, has been elected president of the Electric Institute, Inc (Boston) for 1958. Others elected as officers were **T. H. Carens,** Boston Edison Co, as vice president; **Ralph E. DeLoid,** treasurer; **C. J. Dane,** Bussman Mfg Co, secretary; and **J. A. Galvin,** Boston Ed, assistant secretary.

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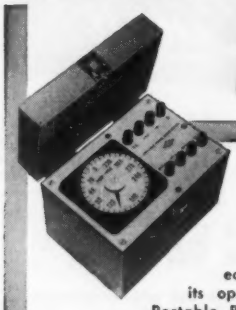

Completely self-contained, and requiring no auxiliary equipment for its operation, this Portable Phase Angle Meter offers a direct way of checking relay and instrument connections, particularly directional over-current relays, differential relays or similar equipment. It may also be used to measure the prevailing power factor in each phase of a polyphase watthour meter installation. The device has a frequency of 60 cycle, with voltage ranges of 60, 120 and 240 volt. Current ranges are 1, 2.5 and 5 amp. . . . DIMENSIONS: 9½ x 6¾ x 5⅝ inches. Weight 19 pounds.

Also available in other voltage combinations
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Personal Briefs

(*Continued from page* 109)

Bluffton (Ind.) Utilities recently named **Nelson W. Edington** as superintendent . . . **John F. Smith** has been elevated from engineer at Duke Power Co's Gastonia district office to electrical superintendent.

Texas Power & Light Co's Farmers Branch office has as its new manager **Billy C. Pool.** He replaces **Jack C. Vaughn,** now Richardson district manager.

At Union Electric Co, **Charles J. Dougherty** has risen to general attorney, and **Harry E. Wuertenbaecher, Jr,** to property tax and permit agent.

Herbert M. Weed is newly elected vice president of Anaconda Sales Co and its subsidiary, Anaconda Export Co . . . At Olin Mathieson Chemical Corp, **Dr W. E. Hanford** has been named vice president-research; and **Richard M. Furlaud,** general counsel. **Robert E. McCormick,** former general counsel, continues as secretary and vice president and assumes broadened corporate responsibilities.

Allis-Chalmers Manufacturing Co has designated the following as assistant works general managers: **R. E. Persohn,** Gadsden (Ala.) works; **H. P. Pinkham,** Boston; and **J. V. McGuire,** Pittsburgh. McGuire is succeeded as manager of the switchgear dept by **D. W. Webb** . . . Industries Group's new director of sales training is **W. L. Manly** . . . **Mark F. Dahlberg** and **Donald J. Nolan** have joined the switchgear dept and nuclear power division, respectively.

Charles J. Cresswell was recently elected comptroller of Electric Storage Battery Co . . . S. Morgan Smith Co has appointed **Frank Aspin** chief production engineer.

OBITUARY

William W. Merrill, 84, president of Chicago Fuse Wire Mfg Co until its sale to Jefferson Electric Co in 1928, died on January 17. Until a few months ago, he operated his own business in Chicago.

REPLIES (Box No.): Address to office nearest you
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Readers Forum

Map in Error

To the Editor:

Looking through ELECTRICAL WORLD, January 13th issue, I was interested in the article on page 85, "Oil-Well Electrification Saves $56,000."

I found an error on the map accompanying the article. North County is listed as the county west of Phillips. If you will check further, I'm sure you will find this should be Norton County. I was born and raised in Norton County, so know that part of the country pretty well. I also worked for Western Light & Telephone Co. at one time. They were also mentioned in the article.

I always try to thumb through your magazine before routing it.

(Mrs.) Betty Reynard
Stenographer
System Engineering Dep't.
Southwestern Public Service Co
Amarillo, Texas

Perforation Worries

To the Editor:

I have just been glancing through the January 6 issue of Electrical World with the perforated pages so that subjects of interest can be taken out without disturbing the remainder.

This is a fine idea if you want to keep the articles in a filing case, but what about we others who take the magazine apart and bind the articles of interest in loose leaf or pinned covers. I do not believe the perforated sheets will stand up very well under this type of binding. For many years I have taken the article of interest out of the magazine and bound it in this manner under subjects.

I do not suppose you would be interested in increasing the width of the magazine sufficiently to make up for the binding edge cut off with the perforations.

E. M. Adkins
Jersey Central Power & Light Co
Asbury Park, N. J.

Sales Assignments

COMPANY STAFFS

Anaconda Wire & Cable Co has appointed Bruce Van Wagner as marketing manager; William Olsen as manager of building wire sales; Robert McIlvane as manager of communication cable sales; Thomas Jackson as assistant manager, industrial sales; and Anthony L. Spina as assistant sales promotion manager.

Brewer-Titchener Corp's new sales manager of the Hi-Line Hardware Division is Harold J. Sandwick.

Chase Brass & Copper Co has transferred six members of its Waterbury Mfg Co division sales staff to the Mill and Warehouse sales organization: T. J. Marshall becomes salesman, forging sales, Waterbury; K. A. Irons, outside salesman, Chicago; J. F. Kenny, outside sales, San Francisco; M. K. Palmer, outside sales, Detroit; William Putich, outside sales, Cleveland; and X. J. Galgota, sales, Waterbury.

Commercial Filters Corp has added to its Chicago sales staff Lawrence Anderson, Jack Berg, and John Kerber.

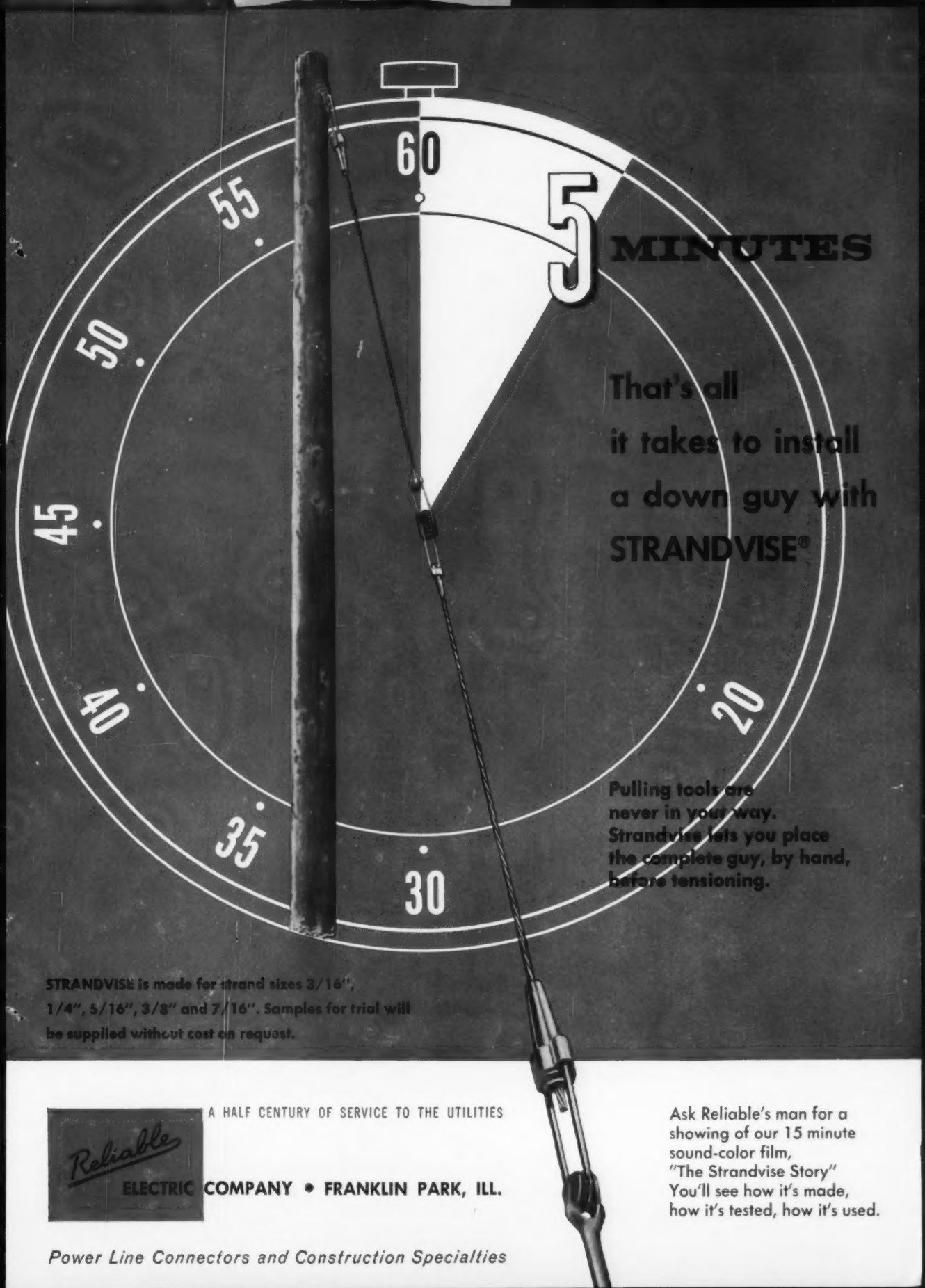
General Electric Co's distributor transformer dept has appointed Harold Brunton, Jr, to manager-network transformer sales, marketing section . . . Charles F. Woods is new manager of dealer development in the sales and distribution dept, Major Appliance Division.

Holan Corp recently made the following appointments: L. H. Stelter, Jr, was named manager of sales and sales engineering; A. C. Adams, district manager for Texas and Oklahoma; Donald Mansfield; salesman for North Carolina, South Carolina, and Virginia region; and T. F. Savage, Jr, as salesman for Florida, Alabama, and Mississippi territory.

Hotpoint Appliance Sales Co has designated J. S. Hicok as regional manager for the eastern region (including Boston, Buffalo, New York, Pittsburgh, and Washington areas) . . . L. J. DiAngelo is new manager of advertising and merchandising for Hotpoint.

Nordberg Manufacturing Co's H. W. Dow, Jr, is new manager of the Engine Division's New York district office.

Riley Stoker Corp's Detroit sales office has as its new district manager E. J. O'Connell . . . At the Worcester sales office, H. W. Moore, Jr, has been made sales engineer.



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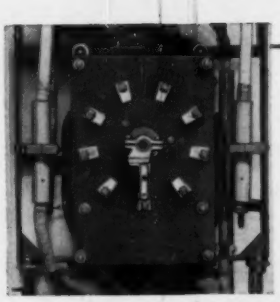
"Select-Amp"—The Moloney "Select-Amp" feature is controlled from the position indicator and allows the range of voltage regulation to be adjusted from a maximum of plus or minus 10% to a minimum of plus or minus 5%. Reducing the range of regulation to plus or minus 5% permits increasing load current to 160% of normal rating. The voltage is raised or lowered in ⅝% steps.

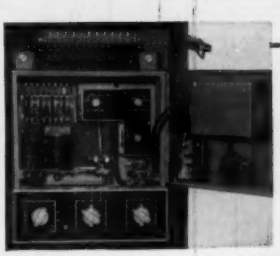
Position Indicator—is directly coupled to the drive mechanism. Resetable drag hands on the position indicator indicate the highest and lowest position the regulator has reached. These drag hands may be reset by operating the reset lever with a hook stick. The position indicator is mounted at an angle to facilitate observation of indicator from the ground.



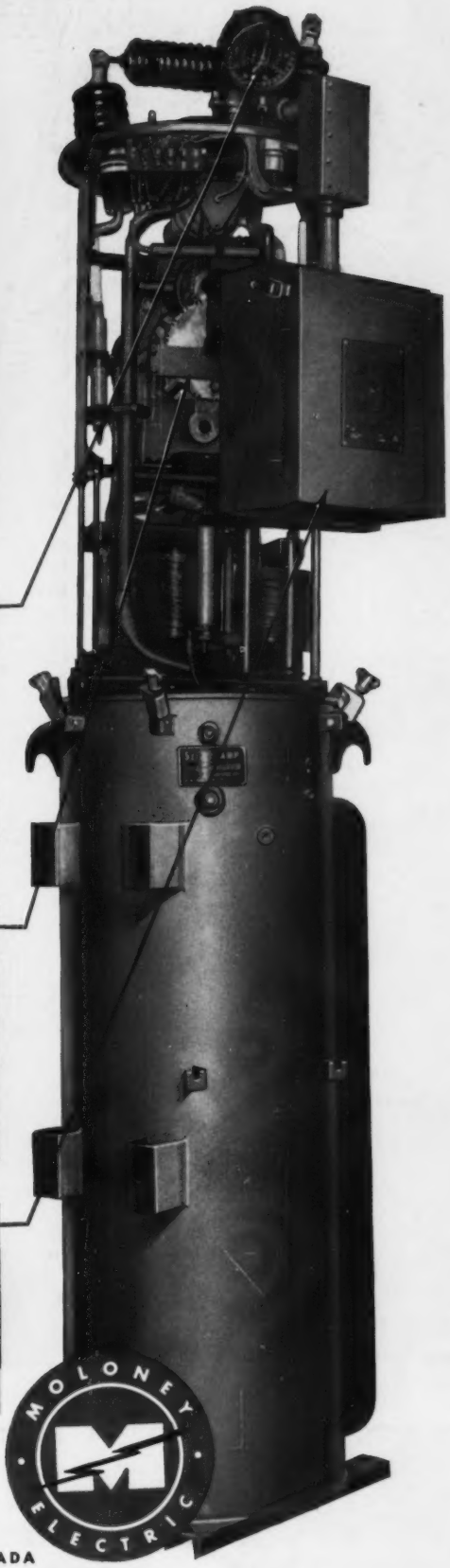
Moving Contact Assembly—consists of arc-resistant copper tungsten contacts contained in beryllium copper clamps, aligned with beryllium copper springs and compressed with coil springs to obtain correct contact pressure. A spring loaded accelerator provides "quick-break", "quick-make" action to all switching, thereby minimizing arcing time, consequently reducing contact wear.

Stationary Contact Blade—is made of copper chrome alloy and is tipped with copper tungsten to minimize arc erosion.

Mounting Panel—is made of heavy bakelite to provide an insulating panel for mounting the switch contacts.



Control Cabinet—The hinged front cover is gasketed and is secured by toggle clamps thereby affording both weather-proofing and accessibility. The toggle clamps are provided with padlock eyes so that the cabinet may be locked to prevent tampering. The cabinet is bolted to brackets on the tank wall and may be removed for mounting at the base of the pole.



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